ANNALS OF SURGERY

VOL. L. SEPTEMBER, 1909 No. 3

## ORIGINAL MEMOIRS.

### AN ANALYTICAL AND STATISTICAL REVIEW OF ONE THOUSAND CASES OF HEAD INJURY.

(*Continued from vol. xlix, page 613.*)

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#### SYMPTOMATOLOGY.

I.—CONSCIOUSNESS AND MENTALITY.—The primary mental disorder was ascertained from the ambulance record, or, if this were impossible, was assumed from the patient's condition upon immediate admission to the hospital; and as here formulated, loss of consciousness might be either transient, considerably prolonged, or permanent.

CASES IN WHICH THE PATIENTS WERE:

| | |
|---|---|
| Entirely unconscious, Fatal, 318; Recovering, 224 | 542 |
| Practically unconscious, Fatal, 30; Recovering, 46 | 76 |
| Conscious with mental state normal, Fatal, 80; Recovering, 209 | 289 |
| Conscious with mental state abnormal, Fatal, 24; Recovering, 28 | 52 |
| Not mentioned | 41 |
| Total | 1000 |

The term "practically unconscious" is used for want of one that is better, and indicates a condition in which there is

no manifestation of consciousness except a recognition of painful sensations, or one in which the patient can only with difficulty be momentarily aroused.

The primary mental disorders were: apathy; delirium, mild or active, muttering or alternating with stupor; and a deficient intelligence as manifested by an inability to realize surroundings, the fact of injury, or even personal identity.

The cases in which no mention is made of primary mental conditions are those of patients transferred from other institutions; and a larger number, usually of gunshot wounds, in which the patient was found unconscious with no obtainable earlier history. It seems probable that the primary condition was in the majority of cases one of unconsciousness in both the second and third classes.

Primary unconsciousness was followed by its immediate loss in about 35 per cent. of fatal cases, and in general was always lost before the close of life. The only exceptions were in cases of intercurrent disease, or from apnœa from the supervention of pulmonary œdema or compression of the respiratory ganglia. In a limited number of cases, as of meningitis, prolonged delirium, or mental decadence, the loss might be considered indirect and chargeable to an exhaustion of the vital powers; but usually and characteristically it occurred as a direct result of the traumatism. A statement made after an earlier study of this subject, that "in a majority of cases unconsciousness is profound, or at least complete, from the receipt of injury to the close of life," requires correction. In fact, this proportion has been found to be rather less than 50 per cent. of the fatalities noted. In 39 per cent. of cases consciousness was immediately replaced by some mental disorder other than delirium.

Whatever might be the primary mental condition, delirium was the most frequent of all the later symptoms, being observed in more than 50 per cent. of that one-half of the cases in which unconsciousness was not permanent; and as a primary symptom it was the most frequent of the mental derangements when consciousness was retained.

The secondary mental changes in fatal cases were not essentially different whether consciousness was retained or lost; there was no constancy in either event. An interval of consciousness and rational intelligence following primary unconsciousness was infrequent; and an interval of stupor, apathy, or mental decadence, though oftener noted, was still confined to a very limited number of cases.

The secondary mental changes in cases which ended in recovery differed with the primary mental state. If it were one of unconsciousness, consciousness might be restored after an interval of moments only, or it might be after an interval prolonged for many days. In the first instance it was usually a direct restoration of rational intelligence; in the second it was often gradual and through stages of mental obscuration or derangement. In either event the final mental condition might be one of permanent impairment. If the primary state were one of unconsciousness and rational intelligence a reference to the tabulation of cases will show that recovery occurred in 70 per cent., as did death in 60 per cent., of those primarily unconscious, but the fatalities were still so many that the mere fact of primary consciousness or unconsciousness can be of itself no guide in prognosis. In a large number of cases which recovered, especially of fractured vertex or moderate general contusion, there was no further mental change. In others, in which hemorrhages or morbid nutritive changes in the cerebrum or its membranes were progressive, the same secondary forms of consciousness or mental derangement necessarily occurred as with the same structural alterations when consciousness was primarily lost. If primary consciousness was characterized by delirium or other mental derangement the termination was usually delayed, and the chances of life and death were nearly evenly balanced.

The relations of these varying phases of consciousness and mentality to underlying anatomical lesions will be illustrated here by some brief abstracts of cases; these like others to follow, while selected with direct reference to some one point, will incidentally illustrate other conditions to which attention will be called.

CASE XXX.—*Primary and Permanent Unconsciousness. Necropsy.*—An unknown man was found unconscious in the street with stertor and general muscular rigidity. He was in profound coma on admission to the hospital, with muscles relaxed and reflexes absent, and with no hemorrhages and no evident external injuries. Temperature 97.4°; pulse 52; respiration 18; right pupil contracted and without reaction; left pupil normal. Coma continued, and temperature rose progressively to 108.2° at death eighteen hours after admission; respiration then 60, and pulse imperceptible.

*Lesions.*—Fracture extending from left inferior parietal region and above the petrous portion into the floor of the left middle fossa; soft epidural clot, 4 by 3 inches, and 2 inches thick, compressing laterally the left frontal, temporal, and parietal lobes, and extending to, but not into basal fossa; pial hemorrhage thinly covering vertex and forming clots in both anterior and both middle fossæ, perceptibly compressing the under surface of both anterior lobes; subcortical laceration in right posterior inferior parietal region; limited contusion of left temporal convolutions; moderate general hyperæmia and œdema confined to upper part of cerebrum.

CASE XXXI.—*Primary and Permanent Unconsciousness. Necropsy.*—The patient fell down a flight of steps and was made primarily unconscious. On immediate admission to the hospital: temperature 102.2°, pulse 130, respirations 36; pupils normal; lack of vesical control; Cheyne-Stokes respiration; patellar reflex absent. Second day: pupils contracted and immovable; temperature 101.8°; coma profound. Fourth day: temperature 104.2°; progressive asthenia; no other change. Died.

*Lesions.*—No fractures; no epidural hemorrhages; two small pial hemorrhages, in right frontal and right parietal region respectively; limited contusion of right frontal lobe underlying the pial hemorrhage, and extending through cortex and subcortex to centre of lobe with numerous punctate extravasations; general cerebral contusion.

CASE XXXII.—*Primary Unconsciousness with Subsequent Delirium. Necropsy.*—The patient was knocked down by a trolley car and rendered primarily unconscious. On admission to the hospital: temperature was 99.6°; pulse, 80; still unconscious. Some hours later he was restless and could be aroused momen-

tarily; incoherent. In twelve hours he was fully conscious and delirious; pupils normal. For first ten days temperature ranged from 101° to 99.4°, and pulse from 80 to 88; rectal control lost; comprehension slow; descending optic neuritis discovered. Still later: active delirium which continued twenty-five days; rectal and vesical control variable; temperature rose to 103.6° and pulse to 128; alternate delirium and unconsciousness. Died on the thirty-fourth day.

*Lesions.*—No fractures; no hemorrhages; laceration of right frontal and temporal lobes; marked cerebral hyperæmia and œdema; cloudy subarachnoid effusion.

Case XXXIII.—*Primary Normal Consciousness.* The patient inflicted upon himself a gunshot wound of the head. He did not fall or lose consciousness for four or five minutes. On admission to the hospital: coma profound; left pupil dilated; respiration became Cheyne-Stokes and both pupils widely dilated and immovable; temperature 99°.

*Operation.*—Large epidural hemorrhage discovered with laceration of the arteria meningea media which was controlled by pressure. Death two hours later.

Case XXXIV.—*Primary Normal Consciousness. Necropsy.*—The patient fell from a loft to the stage of a theatre and was dazed but able to walk about and converse. Thirty minutes later while in a cab he became drowsy, and then somnolent and by his own direction was at once taken to the hospital. On admission: entirely unconscious; temperature 96°; pulse 68; right pupil contracted; left pupil dilated. Death in four hours from time of injury. Temperature 97°.

*Lesions.*—No fracture; epidural clot, 3½ by 3½ inches, on the right side of the cerebrum from rupture of arteria meningea media; no other hemorrhage or laceration; moderate cerebral hyperæmia and œdema.

Case XXXV.—*Primary Consciousness. Necropsy.*—On admission to hospital patient conscious and able to walk when supported, but unable or unwilling to speak; temperature 98°; muscles spastic; pupils irresponsive, and the left dilated; slight mastoid œdema and ecchymosis. Second day: apathetic; face flaccid; rubbed his face with his hands but made no response to efforts to rouse him; temperature 101°. Third day: in the morning, condition unchanged; in the evening, cyanosis and pulmonary œdema; patient unconscious; death fours hours later.

*Lesions.*—Fracture of cranial base involving jugular foramen; thrombus in corresponding lateral sinus; no epidural or pial hemorrhage; laceration of left cerebellar and occipital lobes with cortical hemorrhage in posterior basal fossæ; general capillary extravasation into pia mater; limited area of meningitis over each frontal lobe; thickening of meninges; punctate extravasation in left parietal and occipital lobes; laceration of right frontal lobe; hemorrhagic softening of the right frontal cortex.

CASE XXXVI.—*Primary and Permanent Delirium. Necropsy.*—The patient fell ten feet to the sidewalk and became at once actively delirious. On immediate admission to the hospital: still delirious; condition not alcoholic; temperature 99.2°; pupils normal; hemorrhage from right ear. In nine hours he became still more wildly delirious; temperature 101.4°, and so continued through the night. Second day: temperature 102°; vesical control lost; still delirious. Third day: progressive rise of temperature from 102° to 107.2°; delirium alternating with stupor. Death on the fourth day.

*Lesions.*—Fracture through right middle basal fossa into orbital plate; small epidural and pial hemorrhages in right parieto-temporal region; excessive cerebral œdema and moderate hyperæmia; large serous exudation into meshes of pia mater and into subarachnoid space. Some arachnoid opacity.

II.—TEMPERATURE.—Variations of temperature are perhaps the most significant of the indications of intracranial injury; and considered in connection with the phenomena of consciousness may point directly to the nature and extent of lesion, and often to its probable result.

Temperature above 98°, and not exceeding 99°, will be considered normal.

PRIMARY TEMPERATURE.

| | |
|---|---|
| 92° to 98°: | |
| Fatal cases | 104 |
| Recoveries | 139 |
| 98° to 99°: | |
| Fatal cases | 80 |
| Recoveries | 145 |
| 99° to 100° inclusive: | |
| Fatal cases | 76 |
| Recoveries | 95 |

100° to 101° inclusive:
- Fatal cases ..... 21
- Recoveries ..... 38

101° +:
- Fatal cases ..... 6
- Recoveries ..... 13

102° —:
- Fatal cases ..... 6
- Recoveries ..... 2

102° +:
- Fatal cases ..... 14
- Recoveries ..... 0

In 42 cases the earliest temperature taken was from 102° to 105°, but in 28 of these it was taken after an interval of from twelve hours to six days from the time of injury and could in no sense be considered primary. These and similar cases were excluded from tabulation. The 14 cases remaining were brought under immediate observation.

The one case in which primary temperature reached 105° was that of a man who had jumped from a window while in the delirium of pneumonia.

HIGHEST TEMPERATURE.

100° and below:
- Fatal cases ..... 32
- Recoveries ..... 142

100° to 101° inclusive:
- Fatal cases ..... 23
- Recoveries ..... 121

101° + to 102° inclusive:
- Fatal cases ..... 12
- Recoveries ..... 61

102° to 103° inclusive:
- Fatal cases ..... 22
- Recoveries ..... 48

103° to 104° inclusive:
- Fatal cases ..... 44
- Recoveries ..... 28

104° to 105° inclusive:
- Fatal cases ..... 48
- Recoveries ..... 8

The temperature of 105° in a single case of recovery occurred on the sixth day and was coincident with an attack of some severe intestinal disturbance.

105° to 106° inclusive:
All fatal cases..... 51
106° + to 107° inclusive:
All fatal cases..... 36
107° + to 108° inclusive:
All fatal cases..... 32
108° + to 109° inclusive:
All fatal cases..... 9
109° + to 110° inclusive:
All fatal cases..... 4

It will be observed that when the highest temperature did not exceed 103° the number of recoveries was greatly and favorably disproportionate to that of fatalities; and that when it was above that point the comparative number of fatalities was in still higher percentage than were the recoveries in the former cases. The highest temperature was not always noted at the same period in the progress of different cases, but was usually attained during the last day of life, and was invariably the case when its maximum was at or above 107°. In a single instance a maximum of 108.2° was reached as early as fifteen hours before death, and was without later remission. The rise in temperature was sometimes progressive, either from the beginning or from some later period to the end of life; but was oftener erratic, varying from hour to hour or from day to day within comparatively narrow limits; or perhaps receding from some high degree even to normal or subnormal and after an interval, long or short, again rising to or above its previous maximum. It was the rule rather than the exception that a marked increase occurred at the very end of life, or even in articulo mortis, and this was not infrequently continued for from fifteen to thirty minutes post mortem, and might be fractional or even extend to several degrees. In a case previously reported (Phelps—"Injuries of the Brain," Case 121) the final temperature was 98.6°, and thirty minutes post mortem rose to 109°.

An attempt was made to study the relation existing between opposite axillary temperatures, but was abandoned partly on account of paucity of results, and partly on account of the

impossibility of obtaining efficient co-operation of hospital internes. The cases examined included a certain number both of those which proved fatal and of those which recovered. In general there was a want of correspondence in elevation, usually fractional, but occasionally extending to 1° or 2°, and the higher temperature usually, though not always, continued to be manifest upon the same side of the body. The observations were made for periods extending from one to thirty days. There was no absolute consistency in the amount of elevation or in the side upon which it was exhibited, not even during the same day; and no relation could be established between the asymmetry and the causative lesion except that there was always a general cerebral contusion; and there was none between the side of high temperature and the side on which a limited lesion existed. In every case examined temperatures taken in opposite axillæ were as a rule at all times unsymmetrical, but in no case were they at variance in every observation made.

The most salient fact observable in the tabulation of cases is that with a primary temperature above 102°, or with a subsequent temperature of 105° or above, recovery has never occurred. This is true not only of the cases tabulated, but of the whole 1000 which form the basis of this paper. An apparently exceptional instance of such recovery when temperature had reached 105° was one in which the exacerbation of temperature, as has been noted, was due to an intestinal complication.

It is further observable that more than 50 per cent. of recovering cases have had a primary temperature of from practically normal to subnormal, and in a comparatively small number it exceeded 100°; and that in fatal cases, while the primary temperature in the majority was still normal, a higher degree was proportionately much more frequently encountered later than in those destined to a favorable issue. It is evident therefore that a low primary temperature gives no assurance of the result; but that an elevation above 100° is to be regarded as unfavorable as it approaches the limit of 102°.

The dependence of temperature upon the nature, extent, and complication of intracranial lesions as deduced from an earlier examination of a moiety of these cases has been confirmed by the further examination of their whole number. Hemorrhage in itself does not elevate temperature; it reduces it as it reduces the force of the circulation and depresses all vital functions; meningeal contusion increases it, and cerebral contusion increases it to a still greater extent. If these lesions existed singly diagnosis might be predicated upon temperature alone, but they are always multiple and the effect of one is more or less modified or counteracted by that of another; and as the case progresses new conditions may be introduced as arachnoid inflammation, septic infection, or it may be a simple asthenia.

Temperature, therefore, must be studied in the light of other symptoms; and as a diagnostic sign in ordinary cases it will be found to be most important very early in the case, though it may be highly characteristic of secondary accidents, such as a large subcortical hemorrhage breaking down the brain substance; or the supervention of a meningeal inflammation. It is the coincidence of at least some slight degree of meningeal or cerebral contusion which in a case of epidural hemorrhage occasions after reaction some rise of temperature; and it is the necessary co-existence of meningeal contusion with pial hemorrhage and of cerebral laceration with cortical hemorrhage which in these cases causes its still higher elevation.

The primary or earliest observable temperature has been found to be subnormal in a large percentage of cases, and practically normal in an almost equal number, and in neither case to be indicative of temperature to follow or of the final result. It may be merely one of the indications of a general shock in which an intracranial hemorrhage may or may not play a part. If such a hemorrhage exist as an influential factor, and reaction occur, temperature as already stated in the absence of intracranial contusion would rise to the normal degree and no higher; but with contusion it will continue to rise to some indefinite extent.

The rise may be progressive, or with recessions as circulatory and nutritive conditions vary, and in theory should always measure the extent of these altered conditions; that in fact it does not always do so is because these changes are not always the same in character. There is a possible exception to the rule, that some degree of contusion always accompanies intracranial hemorrhage, when with fracture of the vertex epidural hemorrhage is derived wholly from diplöic vessels.

This collection of cases cannot be said to confirm the theory of an existence of specific heat centres. If high temperatures have often been coincident with limited lesions which have involved regions described as specifically thermogenetic, they have equally characterized cases dependent upon lesions of every other part of the brain. The most extreme elevations and rapid progressions of temperature have been noted when with no localized injury there have been evidences of a profound general contusion. The extent and severity of intracranial injury rather than its limitation to any defined areas would seem in the light of clinical observation to determine excessive thermogenesis whatever its proximate cause.

It is not unsupposable that the primary subnormal temperatures may depend upon the abeyance of nutritive processes in the cerebral and meningeal cells in the first shock of injury, and that the subsequent excessive elevations may depend upon abnormally rapid destructive changes which follow the circulatory derangement.

The progressive rise of temperature which in so large a proportion of cases continues for thirty minutes or more after death, and sometimes to a remarkable extent, as a mere continuation of processes originating ante mortem requires no independent explanation. It is not observed after death from other forms of injury, but has an analogue in cases of Asiatic cholera.

ILLUSTRATIVE CASES.

*Continued Subnormal Temperature.*—See Case XXXIV.—*Consciousness.*

CASE XXXVII.—*Subnormal, Rising to Normal Temperature.*

*Recovery.*—The patient fell ten feet to a ship's deck; consciousness lost for twenty minutes; both pupils dilated. On admission to the hospital: stupor; temperature 97.6°; right radial pulse 92, and the left 100 in the minute; hemorrhage from the right ear and nostril; right pupil dilated.

Temperature and pulse became normal in three hours, and there were no further symptoms except frontal headache; no memory at any time of having been injured.

CASE XXXVIII.—*Subnormal, Rising to High Supranormal Temperature. Necropsy.*—An unknown man was seen to fall in the street and was taken by way of a police station to the hospital.

On admission: patient in profound coma; temperature 92°; pulse, 48 and weak; respirations, 40, shallow and almost imperceptible; small contusion over right parietal eminence and another over left mastoid process; no extracranial hemorrhages; left pupil much dilated, the right contracted, both immovable; right patellar reflex exaggerated; the left normal.

Five hours later: temperature 101.8°; pulse 80, slow and irregular; respiration 38, occasionally Cheyne-Stokes.

Second day: patient still unconscious; temperature 103.2°–103.6°; pulse 80; respiration 30; left pupil normal in size but still immovable.

Third day: pupils symmetrical, contracted, and without reaction; right external strabismus; face cyanotic; temperature 101.4°–104.6°; pulse 80–100; respirations 38–48.

Fourth day: cyanosis continued; temperature 103.2°–103.4°.

Fifth day: temperature 104°–106°; respirations 54–56; death; consciousness at no time regained.

*Lesions.*—Fracture extended from a point corresponding to external contusion, and internally from a point in groove for left lateral sinus at junction of sigmoid, across groove for superior petrosal sinus to left superior occipital fossa near median line; fracture linear; posterior wall of lateral sinus torn for three-fourths of an inch and still gripped in the closed fissure; blood extravasated from sinus formed a thick clot over whole left hemisphere anterior to occipital lobe and filled left posterior and middle basal fossæ; no cerebral laceration; excessive hyperæmia and œdema of whole brain including cerebellum.

CASE XXXIX.—*Normal, Rising to High Supranormal Tem-*

*perature. Necropsy.*—Ambulance history: coma; complete left hemiplegia; right pupil dilated and immovable, the left normal; hemorrhage from right ear.

On admission to hospital: symptoms unchanged; no superficial injury; temperature 98.8°; pulse 92; respirations 20. Later: loss of vesical control; temperature rising to 101.4°; momentary return to consciousness after twelve hours.

Second day: symptoms not materially changed; patient very restless; both pupils markedly dilated; temperature 103°–105.4°–104°–106°; pulse 144–120; respiration 45–50–20; one violent epileptiform convulsion.

Third day: extreme restlessness and widely dilated pupils; temperature 107°–109.4°. Death.

*Lesions.*—Linear fracture through right squamous portion, and along anterior surface of petrous portion of temporal bone to sella turcica; contusion of anterior surface of petrous portion; epidural hemorrhage from laceration of trunk of right arteria meningea media, with clot compressing whole lateral aspect of cerebrum, and escape of blood through squamous fissure into temporal muscle; laceration of left temporal lobe with moderate cortical hemorrhage in middle fossa; excessive œdema of entire brain including cerebellum, basal ganglia, and medulla; moderate serous effusion in left lateral ventricle and in subarachnoid space.

Case XL.—*Primary and Continued Supranormal Temperature. Necropsy.*—A man was found unconscious a few hours after his return to his apartment, and was sent to the hospital.

On admission: fully unconscious; temperature 102.4°; pulse 92; respiration 36; no external injuries except some œdema behind the right ear, some small blood clots in nares and right external auditory meatus; pupils widely and symmetricallly dilated, and without reaction; superficial and deep reflexes absent; responded to painful sensations; lack of rectal control.

He survived seven days without regaining consciousness, except that he once or twice opened his eyes when disturbed, and continued to respond to painful sensations, as when a hypodermic needle was inserted. Rectal control was not restored; urine from the beginning was voided at regular intervals apparently without volition or consciousness; the pupils became normal in size and reaction on the fourth day; muscular spasticity which had been noted on admission continued in upper extremities, but disap-

peared in the lower on the second day; fluid nourishment was retained; temperature varied from 102° to 101.6° on the second and third days; from 102° to 101° on the fourth day; from 101° to 103° on the fifth day, and from 103° on sixth day to 107° at death on the seventh day; and was 109° post mortem; pulse varied from 74 to 100 and was 112 at the last; respiration was usually normal in frequency but was occasionally accelerated.

Incision failed to discover fracture. On the third or fourth day operation was suggested by other surgeons who saw the case, but the suggestion was not accepted in view of the early and later temperature conditions, although the existence of intracranial hemorrhage was recognized.

*Lesions.*—Fractures: one extending from right parieto-occipital region through middle fossa to foramen lacerum anterius, and a second extending from one optic foramen to the other through the sphenoid body; epidural clot filling right middle fossa and extending upward upon the cerebrum; numerous lacerations of left frontal and temporal convolutions and central gyrus, right frontal and parietal lobes, and both gyri fornicati; disintegration of superior surface of right optic thalamus; areas of limited contusion in various parts of both hemispheres; intense hyperæmia of entire brain and meninges.

Case XLI.—*Moderate Temperatures not Measuring the Amount of Severe Cerebral Contusion. Necropsy.*—A woman, 60 years of age, fell down stairs and was at once sent to the hospital.

On admission: patient could be aroused to answer questions; irritable; temperature 99.6°; pulse 86; respiration 28; hæmatoma in left posterior parietal region; pupils normal; incomplete left facial paralysis, and slight twitching of both hands.

Second and third days: condition unchanged.

Fourth to ninth days: generally in stupor and unable to recognize her friends or surroundings; rational at times; very irritable when aroused; temperature varied from 99.2° to 100°; once rose to 101°; pulse 68 to 136; respirations 20 to 34.

*Lesions.*—Meninges hyperæmic; extensive subcortical laceration of right cerebrum from angular gyrus to descending cornu of lateral ventricle; several smaller lacerations nearer the base; brain œdematous; bloody serum in both lateral ventricles, and choroid plexus markedly œdematous; small hemorrhage upon

floor of fourth ventricle; laceration in middle of right optic thalamus, and another in anterior part of right internal capsule; two small hemorrhages in left frontal lobe, and another larger just above anterior prefrontal space.

The relations of consciousness and temperature to the nature of the lesion as deduced from this series of cases and as apprehended by the writer have been more than once formulated, and are here restated:

The loss of consciousness,[16] which immediately succeeds a cephalic injury, is always the result of diffuse cerebral contusion; if unconsciousness is preceded by a conscious interval, however brief, or if after restoration of consciousness its privation soon recurs, it is occasioned by some form of intracranial hemorrhage. If, however, primary unconsciousness is permanent or greatly prolonged, its continuance may be due either to the severity of cerebral lesion or to a complicating hemorrhage; and whether the one has persisted from the beginning or been at any time replaced by the other, or whether both exist together, can be determined, if at all, only by a study of all the symptoms presented. The pulse, temperature, and respiration must be systematically recorded in every case from the first opportunity afforded for observation until the end . . . of these; the temperature in its course and variations will afford in the greater number of cases the most distinctive indication of the nature of the lesion . . . If, then, after the lapse of hours consciousness still remains in abeyance, a stationary temperature of but one or two degrees above the normal standard will indicate a hemorrhage of some profusion without serious cerebral injury; but a higher elevation which constantly increases, with possible recessions, will point to a visceral lesion. . . . The cases in which consciousness after brief restoration is again lost permanently, or for a lengthened period, have the same relations to temperature as those in which unconscious-

[16] Phelps—"The Question of Early Operation in Cases of Intracranial Injury." ANNALS OF SURGERY, December, 1906.

ness has been uninterrupted. It will be recalled that the recurrence of unconsciousness after an early interval of sensibility is indicative of an increase or supervention of hemorrhage, and that at a later period more or less conscious intervals in a general unconscious condition result from a lessening from time to time of the hyperæmia or œdema of a diffuse cerebral contusion. The question of hemorrhage should scarcely arise in the last instance, but the temperature still conforms to the general rule.

III.—PULSE.—The examination of the pulse in 745 cases in which pulse and temperature had been systematically recorded afforded some results of importance. The classification of pulse rate and temperature here adopted is necessarily arbitrary, but may be considered as essentially correct.

*Temperatures:*
Subnormal, 98° and below.
Normal, 98° + to 99° inclusive.
Supranormal, 90° +.

*Pulse rates:*
Subnormal, below 70.
Normal, 70 to 80 inclusive.
Supranormal, above 80.

The following tables are constructed in view of pulse and temperature relations.

| | Fatal Cases | Recoveries |
|---|---|---|
| *Primary Subnormal Pulse:* | | |
| With subnormal temperature | 36 | 30 |
| With normal temperature | 16 | 10 |
| With supranormal temperature | 32 | 33 |
| *Primary Normal Pulse:* | | |
| With subnormal temperature | 36 | 54 |
| With normal temperature | 21 | 41 |
| With supranormal temperature | 20 | 47 |
| *Primary Supranormal Pulse:* | | |
| With subnormal temperature | 33 | 60 |
| With normal temperature | 36 | 53 |
| With supranormal temperature | 86 | 101 |

The inferences which these figures justify are not essentially important, allowance being made for the greater number

of recovering cases examined. Different combinations of pulse and temperature afford various percentages of subsequent deaths and recoveries; but the variations are not sufficient to form a basis for prognosis. Since these groups of cases necessarily merge along their lines of contact, a further comparison was made of cases as far removed from these lines as possible.

*Subnormal Temperatures*—97° to 92°.

*Fatal Cases:*

Pulse subnormal—Rate 68 to 46..... 15
Pulse normal—Rate 70 to 78..... 5
Pulse supranormal—Rate 100 to 144..... 5

*Recoveries:*

Pulse subnormal——Rate 56 to 66..... 5
Pulse normal—Rate 70 to 78..... 6
Pulse supranormal—Rate 100 to 144..... 14

*Normal Temperatures*—98.4° to 98.6°.

*Fatal Cases:*

Pulse subnormal—Rate 60 to 64..... 2
Pulse normal—Rate 70 to 80..... 9
Pulse supranormal—Rate 84 to 110..... 4

*Recoveries:*

Pulse subnormal—Rate 60..... 1
Pulse normal—Rate 76 to 80..... 7
Pulse supranormal—Rate 88 to 98..... 7

*Supranormal Temperature*—104.4° to 101.6°.

*Fatal Cases:*

Pulse subnormal—Rate 52 to 68..... 8
Pulse normal—Rate 0..... 0
Pulse supranormal—Rate 84 to 140..... 17

*Recoveries:*

Pulse subnormal—Rate 60 to 64..... 3
Pulse normal—Rate 70 to 80..... 4
Pulse supranormal—Rate 84 to 120..... 18

In all cases in which primary temperature was 102°, or above that point, the pulse rate was supranormal, at least 100 and usually much higher, except in certain cases of

alcoholism, and in two others—one with embarrassed respiration and cyanosis and one which is inexplicable and will be included in the series of illustrative cases.

It does not appear from this later and more representative table that any practically important deductions affecting prognosis can be made from observations of the primary pulse. Generalizations are still found to be based upon differences in percentage too small to be of value. An exception to this general statement is in the fact that when temperature is not above 97° and pulse not above 66 death results in 75 per cent. of cases.

The primary pulse has some relation to the nature of the lesion. In cases of general contusion with or without laceration, but without hemorrhage of importance, it was normal, subnormal, or but slightly accelerated. If general contusion was accompanied by a considerable hemorrhage, usually pial or cortical, a supranormal pulse of 100 or more was so frequently encountered as to afford a fair presumption of such a complication of lesions. If the essential lesion was a hemorrhage it was usually epidural, and a subnormal or practically unaccelerated pulse was noted in 75 per cent. of cases.

*Secondary Pulse.*—In the progress of the case a discrepancy in the pulse rate and temperature elevation often become so marked as to be distinctive. This may occur at any period before the final stage when a decided acceleration of the pulse and elevation of temperature are usually coincident.

In the histories of 132 of the fatalities and of 201 of the recoveries in the second series of 500 cases, the records of pulse and temperature were sufficiently preserved to illustrate this abnormal relation. In 35 of the fatalities and 72 of the recoveries, 26 per cent. and 35 per cent. respectively, the pulse rate was normal or subnormal when the secondary temperature was above 100°; and in about one-half of these it decreased progressively as the temperature rose from the primary or immediately previous observation. Additional cases in which equally high temperatures are associated with a pulse rate

somewhat above but approximately normal, as from 80 to 90 in the minute, materially increase the percentage of nonconformities of pulse to temperature and confirm an impression derived from superficial clinical observation. Such characteristic want of correspondence between pulse and temperature is not observed in the course of any other form of injury or disease.

There are still other cases in which though the temperature, pulse and respiration are in harmony and practically normal, they are all at variance with related conditions. The patient suffering from the shock of serious injury may be supposed to have a subnormal temperature, feeble rapid pulse, and shallow or sighing respiration; but it sometimes happens that with a cerebral lesion, and with a cold, moist surface, and other recognized symptoms of shock, there is no disturbance of either temperature, circulation, or respiration, or at most some diminished tension of a pulse of normal frequency. In more frequent instances, though the essential element of surgical shock or collapse is an impairment of the vasomotor system and circulatory failure, the pulse remains of normal or nearly normal character while the temperature falls. Whatever may be the explanation there certainly is in some cases a difference in the indications of shock or collapse as it results from intracranial, or from other traumatism. The presence of some phenomena of the more general depression and the absence of others, serve to specialize the primary effects of these particular lesions—perhaps by reason of special ganglionic centres involved.

A single case may be quoted in illustration of what might be termed cerebral shock, and incidentally of a pulse peculiarity to be mentioned a little later.

CASE XLII.—*General Shock with Normal Pulse, Temperature and Respiration. Recovery.*—A lad 8 years of age was crushed between a wagon and a fence, receiving no injuries except of the head. On immediate admission to the hospital he was in stupor, but could be aroused and then complained of nausea and

vertigo. The skin was cold, pale and moist, the temperature 98.4°, the pulse 70, and the respiration 24. There was right facial paralysis, free hemorrhage from the right ear, contraction of the right pupil, and greater fulness and force of the right radial pulse than of the left. The external injuries were a wound in the left parietal, and a contusion of the right frontal region. During the first hour he vomited repeatedly. On the morning of the second day the pupils were both contracted, and in the evening they were both dilated, and he was delirious. His highest subsequent temperature was 101°.

At the end of the third week he had no symptoms remaining except some facial paralysis and dilatation of the pupils.

The want of conformity of pulse to temperature will be observed in many of the cases to follow. It will be found to be very marked in Case XXXVIII. The force and fulness of the pulse in general are not characteristic, and are as variable in intracranial as in other traumatisms.

*Asymmetry of Opposite Radial Pulsations.*—There is another pulse condition which is peculiar to this class of injuries. This is usually a want of correspondence in the force and fulness of arterial pulsation upon opposite sides of the body, and usually noted at the wrists. The increased tension is often wanting, and in rather exceptional cases the pulse rate differs while force and fulness may or may not remain the same. The frequency with which these aberrations occur is at the present time impossible to say; but the frequency with which they are noted seems to depend upon the care with which symptomatology is studied. It is probable that they can be discovered in a large minority, if not in the majority of cases in which opportunity is afforded for early and frequent observation. The summary of this subject made for the earlier collection of cases (Phelps, "Injuries of the Brain," p. 122 *et seq.*) requires little modification for the present larger number, and is reproduced with only slight modifications.

The want of symmetry in opposite radial pulsations was first recognized in the prosecution of that work in May, 1893, and since then has been found to exist in a considerable pro-

portion of the cases in which it has been sought. It is most frequently a primary aberration, but may not occur until the second day or even later. It is sometimes transient, disappearing in a few hours, sometimes intermittent but oftener continuous for some days if the patient survive. The bilateral variation usually attaches to strength and fulness of the pulse, or to its fulness alone, while in other respects the pulse is symmetrical with its fellow. In some instances the fulness and strength of pulsation upon one side are in startling contrast to its weakness and tenuity upon the opposite; in others the difference is slight, and to avoid the possibility of error if doubt existed was excluded from the record. The original characteristics of each radial pulse are ordinarily retained so long as a difference exists, but such are occasionally interchanged.

The stronger and fuller pulse has been found on the right side rather more frequently than on the left. It was observed on the first day in about 75 per cent. of cases, and while its later recognition may have been due in some instances to earlier neglect, in others primary symmetry was positively known from careful observation.

It has occurred in both fatal and recovering cases, but much more frequently in the former, 70 per cent. or more, and in the latter has almost always been in those of a serious character. The pulse has been usually of good force at both wrists, though exceptionally it has been weakened, and on one side even imperceptible. In one instance, perhaps anomalous, the left radial pulse was full and strong and the hand warm, while the right pulse was feeble and the hand cold. In a single instance, also exceptional, the smaller pulse had the greater tension. The opposite pulse rates only occasionally differed and then not to exceed eight or ten pulsations to the minute. This discrepancy occurred both as an independent phenomenon, and associated with the other asymmetric conditions.

The necropsies have disclosed all forms of hemorrhage—epidural, pial and cortical—variously situated; lacerations of

all lobes and of basal ganglia; and always with some degree of contusion which was sometimes the essential lesion. There were hemorrhages without laceration, and contusion without hemorrhage. The inferential lesions, those indicated by symptoms but not demonstratable later by direct inspection, were no less diversified. When limited lesions were discovered, the fuller and stronger pulse had been on the opposite rather than on the same side in a proportion of nearly two to one. There were limited lesions on both sides of the brain, or only a general lesion in a fair proportion of cases.

It is impossible, therefore, to infer the character or location of lesions from this sympton; it is equally so from any correlation which may exist between it and other symptoms by which it is accompanied. A fact important in another connection is that it is almost if not quite always associated with an abnormality of the pupils or a loss of vesical control.

### ILLUSTRATIVE CASES.

CASE XLIII.—*Primary Asymmetrical Pulsations. Necropsy.*—A man fell fifteen feet and then walked across town to the hospital. After admission he had a chill which lasted nearly two hours, and was practically unconscious until death five hours later. The right pupil was widely dilated and without reaction and the orbital region was markedly ecchymotic. Pulsations of the left radial and brachial arteries were strong and full, and were very weak and small in the corresponding arteries of the right side. Four hours after admission temperature had risen from 98° to 104.6°, pulse from 40 to 64; and respiration had fallen from 36 to 32. Temperature at death was 105° and thirty minutes post mortem was 105.4°.

*Lesions.*—Fracture through right middle fossa involving the temporal bone and the greater wing of the sphenoid, and lacerating the anterior branch of the middle meningeal artery; firm epidural clot occupying right middle fossa and extending over temporal lobe; small laceration of opposite temporal lobe; small extravasation into the pons; and small contusion in left Sylvian fissure. The right temporal lobe was flattened laterally and inferiorly, and when the epidural clot was removed the brain

retained its position widely separated from the middle fossa—including the outer half of the anterior surface of the petrous portion of the temporal bone. The small superficial cerebral vessels were distended, and the surface between them, at first pale, was soon reddened by a blush generally diffused. The surfaces of cerebral section soon became deeply reddened and bathed in watery effusion.

CASE XLIV.—*Primary Asymmetrical Radial Pulsation. Death.*—A child 2 years old fell two stories. The temperature on admission to the hospital was 100°; pulse 126; respiration 36. The right pulse was small, rapid, and irregular, the left only faintly perceptible; the pupils were dilated and the patient was unconscious. There was marked tonic contraction of the flexors of the fingers and extensors of the forearm, and later general convulsions which continued until death in the evening of the same day.

Incision made soon after admission disclosed extensive comminuted fracture of both parietal, both temporal and right occipital bones, and laceration of left posterior parietal lobe.

CASE XLV.—*Alternating Asymmetrical Radial Pulsation. Recovery.*—A man who had been found unconscious at the foot of a flight of stairs was admitted to the hospital with temperature 96.4°, pulse 66, and the right radial pulsations much fuller than the left. The respiration was irregular, sighing and chiefly abdominal; the left pupil was dilated and without reaction, the right contracted and responsive; the muscular system was completely relaxed; the urine was retained and the clothing stained with fæces. Hemorrhage from the right ear was constant and profuse, and there was blood in both nostrils. Some consciousness was soon regained and pupils became contracted and both responsive. The right radial pulse remained fuller and stronger than the left till the fourth day when the left became the fuller and stronger; and on the fifth day it was again the right, and on the sixth day radial pulsations were symmetrical. On the ninth day the radial pulse was once more the fuller and stronger, and on the tenth day pulsations were again symmetrical. The right radial pulse continued the stronger from the eleventh day, but on the twenty-third it differed but slightly from the left, and afterwards no difference was perceptible and all general symptoms ceased. The progress of the case was otherwise interesting. The

temperature rose on the second day to 102°, and there was a discharge of sanguinolent fluid and of disintegrated brain matter from the left ear, which on the third day was a simple oozing. The patient on the second day was exceedingly voluble and afterwards had occasional delusions of locality. Dilatation of the left pupil was persistent and was accompanied at times by left internal strabismus. The temperature became normal three hours after admission, then at once rose to 101.8°, and continued at high degrees, often above 103°, till the thirteenth day and afterward was below 100°. The pulse rate was usually normal after the second day but occasionally rose to 100 and once fell to 44. The respiration was usually from 20 to 24 but at times subnormal.

CASE XLVI.—*Secondary Asymmetrical Radial Pulsation. Recovery.*—A man who had been struck by a trolley car was admitted to the hospital still unconscious: Temperature 99.4°, pulse 70, respiration 18; pupils symmetrically dilated and without reaction; internal strabismus; radial pulsations symmetrical; reflexes normal.

Fifteen minutes later the pupils contracted, and the strabismus disappeared. Twelve hours later urine was retained. On the second day he was conscious and rational and vesical control was restored. On the third day the left radial pulse was fuller and stronger than the right; and on the fourth day radial pulsations were again symmetrical. No further symptoms.

CASE XLVII.—*Secondary Asymmetrical Radial Pulsation. Necropsy.*—The patient, whose manner of injury was unknown, was found in the street, conscious, slightly delirious, and with hemorrhage from the nares. On immediate admission to the hospital his general condition was unchanged and his temperature was 102°; his pulse 68, and his respiration 20. On the second day his pupils were contracted, his right pulse was weaker than the left, and his temperature rose to 105°. On the fourth day rectal and vesical control was lost and he was stupid and drowsy. He survived until the sixteenth day and consciousness was retained till the last twelve hours. His mental condition was variable; usually stupid, drowsy, irrational, restless, and at times delirious. Rectal and vesical control were not regained; the pupils were dilated and at times widely so; temperature usually high, varied from normal to 104°, and at the end was 105.4°. The asymmetry of the radial pulsations continued, and as late as

the thirteenth day the greater fulness and force of the left pulse was noted.

*Lesions.*—Fracture confined to the right orbital plate; no hemorrhages; no lacerations; intense hyperæmia and moderate œdema of the brain substance.

CASE XLVIII.—*Secondary Asymmetrical Radial Pulsation Including Frequency. Recovery.*—A man who had been struck with a bar of iron was at once admitted to the hospital, conscious, irrational and alcoholic. Temperature 99°; pulse 88; respiration 20. There was a lacerated wound over the parietal eminence and no other symptoms. On the second, fifth and seventh days the right radial pulse was fuller and more compressible than the left. On the third day the left pulse was 76 and the right 72, and on the sixth day respectively 84 and 79 in frequency. Left facial paralysis was manifest on the second day, and still existed in very slight degree when discharged from the hospital. The pupils were normal and rectal and vesical control was retained. Temperature rose to 103° on the fourth day with normal pulse and respiration, and to 102.4° on the eighth day with pulse and respiration still normal. On the twelfth day temperature was 98.6°, and there were no symptoms.

Case XXXVII affords an example of unequal pulse rates with pulsations otherwise symmetrical.

CASE XLIX.—*Discrepancy in Local Temperatures and Asymmetrical Radial Pulsation. Recovery.*—A man fell eight or nine steps down a stairway. On admission to the hospital he was in coma with a profuse hemorrhage from the left ear which continued two hours. The pupils were unequally dilated; the right radial pulse was feeble, and right hand cold; the left pulse was full and strong, and the left hand warm; and there was no apparent external injury. Consciousness returned gradually and was complete in six hours; the mental condition was then normal. There were no subsequent symptoms except severe left frontal pain and a sense of fulness in the head. At the first observation made five hours after admission, the temperature was 104°, the pulse 96, and the respiration 36. Later in the same day the temperature was 100°–103°, pulse 96–138, respiration still 38. Afterward the temperature was 99° and pulse had no noticeable peculiarity.

No definite relation was found to exist between intracranial tension and the general arterial pressure which might remain normal or be either increased or diminished, or might vary in the progress of an individual case. The cases selected for examination as to this relationship were such as well indicated the increase of intracranial tension by some of its characteristic symptoms, as loss of consciousness, high temperature with infrequent pulse, pupillary disturbances, and lack of rectal and vesical control. Arterial pressure was increased in a small minority of cases, markedly lessened in a much greater number, and normal or slightly lessened in the great majority.

IV.—Respiration.—The respiration in ordinary cases is not characteristic. In general, it is oftener than otherwise moderately accelerated in the beginning, and in fatal cases, as with other injuries and disease, becomes very frequent towards the end. In recovering cases which are not greatly prolonged there is not usually a notable acceleration; and whatever the issue is to be, even with primary general shock, it is often primarily normal. Peculiarities of rhythm occasionally occur, and stertor, sometimes a symptom, is less frequent than usually supposed.

There is, however, a class of cases in which respiration is diagnostic. In these it may be shallow with cyanosis and pulmonary œdema; or it may suddenly cease, or be progressively retarded until there are not more than one or two respiratory acts in the minute. In either event there is subdural hemorrhage, pial or cortical, in one or both posterior basal fossæ. Indirect pressure exerted through the dura mater by an epidural hemorrhage does not produce the same result. The phenomena in the first instance seem to be due to direct pressure upon the intracranial portion of the pneumogastric nerve. It is of course assumed in diagnosis that cases are to be excluded in which with cardiac failure bronchial râles are formed *in articulo mortis*. In the second instance pressure is made upon the respiratory ganglia either by a limited clot or by the mass of fluid blood extravasated. These pressure conditions may occur separately or together, and cyanosis

may be the result of retarded respiration without the direct pulmonary lesion. In one case noted there was no hemorrhage into the fossæ and the pressure upon the medulla was made by a clot formed from blood derived from the ventricles.

There is reason to believe that a clot sometimes begins to form upon the medulla and is later washed away by continued hemorrhage. This may serve to explain instances of very slow primary respiration which soon becomes and remains normal or frequent. Special reference was made to such a case in a previous consideration of this subject.[17] The respiration was five in the minute on first examination and subsequently ranged from thirty-six to forty-six till death. Small coagula found upon the medulla were thought to be probable "traces of a larger hemorrhage which primarily encroached upon its lateral aspect and at that time retarded respiration."

Compression of the medulla was noted in 34 cases, in 23 of which the nature of the lesion was made manifest in post-mortem examination. In five instances, all of gunshot wound, death occurred at once or in the ambulance without opportunity for observation of symptoms if any existed, but in each the identity of the fatal lesion was unmistakable. In 24 of the remaining 29 cases respiration was progressively diminished in frequency and in the 5 others its cessation was sudden. In all cases primary temperature was below or but slightly above normal; in nearly all, consciousness was lost on admission; and in more than one-half, respiration primarily was abnormally infrequent. The interference with respiration usually occurred, if at all, very soon after the injury was received, but was sometimes deferred for several hours, and in one instance until the sixth day. Death followed in from a few moments to a few hours, and as in asphyxia generally the cardiac pulsations continued for an appreciable time after respiration had ceased. Other subarachnoid effusions, inflammatory or simply œdematous, did not check the respiratory movements.

In the 23 cases subjected to post-mortem examination the

[17] Lib. cit., p. 101.

usual complication of lesions existed, but the hemorrhage into the occipital fossæ was always present; and in a large proportion of cases a clot rested upon the medulla, and often with no other considerable hemorrhage. If the clot was absent the basal hemorrhage was large. The clot often extended over the pons, but when confined to that part, as was to be expected, it did not affect respiration.

This peculiar respiratory default can hardly fail of recognition, and it can rarely be anticipated; but the fact that a serious intracranial hemorrhage has occurred may be obvious, and with it an abnormally infrequent respiration is to be regarded as suspicious. A lesser number of respirations than fourteen in the minute occurs in a few instances, and in nearly all of these it is the precursor of a fatal result, and probably indicates a medullary compression. On the other hand in nearly 50 per cent. of such compressions primary respiration was normal or abnormally frequent; so that while a primary infrequency of respiration may have some prognostic significance, its absence can have none.

While apnœa from direct compression of the respiratory ganglia may have no great prognostic or therapeutic value it is a definite symptom and result of intracranial injury and an integral part of its history, and as such still has a special interest and importance.

Peculiarities of respiratory rhythm, of which the Cheyne-Stokes is an example, are not confined to this class of injuries and when they exist are attributable to cerebral lesion.

### ILLUSTRATIVE CASES.

Case L.—*Progressive Retardation of Respiration. Necropsy.* —Ambulance history: coma; extreme shock; wound over left eye; right pupil contracted, the left dilated, and both immovable; no hemorrhages.

On admission to the hospital: patient unconscious; pupils as before; surface pale and cold; face slightly cyanosed; marked subconjunctival hemorrhage in both eyes; slight right exophthalmos; reflexes absent; lack of vesical control; hæmatemesis; tem-

perature 98.2°, receded to 98°, and post mortem was 98.6°; pulse 69–120–90; respiration on admission, 14; in one hour, 12; in two and one-half hours, 9; in three hours, 5; in three and one-fourth hours, 3; two minutes later unchanged; three to ten minutes later still, 2; and *in articulo mortis,* ten minutes afterward, 1; cyanosis then extreme.

*Lesions.* —Fracture extending from floor of left middle fossa through both anterior basal fossæ, comminuting left orbital plate; thick epidural clot compressing laterally left frontal and temporal lobes; rupture of left middle meningeal artery at its bifurcation; pial hemorrhage in right posterior basal fossa with clot extending over pons and medulla; general hyperæmia and marked cerebral œdema; limited contusion of orbital convolutions.

Case LI.—*Progressive Retardation of Respiration. Necropsy.*—Pistol-shot wound through right temporal fossa; permanent unconsciousness; unsymmetrical dilatation of pupils; left corneal reflex absent; urine retained; some pulmonary œdema; temperature 96.4° to 96° for five hours and later declined to 95.6°; pulse 85, 94, 80; respiration on admission to hospital, 14; for one and one-half hours, 12; in two and one-half hours, 10; in three hours, 8; in four and one-half hours, 6; in five hours, 4; and a few minutes later *in articulo mortis,* 2. Cardiac action said to have continued for three minutes.

*Lesions.*—Bullet severed right middle meningeal artery, passed through third right temporal convolution, and was lodged in the posterior part of the inner border of the right temporal lobe; small piece of bone driven in advance of the bullet found between the right lateral columns of the medulla; large mixed epidural and cortical clot filled middle fossa, spread over whole right hemisphere, and thickly covered pons and medulla; hyperæmia of right hemisphere including basic ganglia of considerable intensity.

Case LII.—*Abrupt Cessation of Respiration. Necropsy.*—Patient fell fifteen feet and struck his head upon the pavement. On immediate admission to the hospital: unconscious; hemorrhages from nose and mouth; orbital ecchymoses; slight laceration of left ear from which blood had trickled deep into external auditory meatus; right pupil contracted and immovable; left pupil dilated and feebly reacting to light; vomiting at intervals; patellar reflexes absent; hemiplegia and anæsthesia complete on right, and incomplete on left side and of right face; left face

normal; temperature 99°; pulse 45; respiration 10. Twenty-two hours later temperature 101°; pulse 80; and respiration then normal ceased abruptly. Radial pulsations, 80 to 90 in the minute, and of good force, continued for an appreciable time afterwards.

*Lesions.*—No injury of scalp except some slight contusion of its deep surface in the left frontal region; left temporal muscle infiltrated with blood; fracture extending from a point in left parietal region directly above the ear across petrous portion and middle basal fossa into orbital plate which it comminuted; no epidural hemorrhage; thick cortical clot covering anterior part of left temporal lobe, from which a thin sheet of blood extended over whole left frontal and parietal lobes, anterior part of left occipital lobe, and first and second right parietal convolutions. Blood from left temporal region had also flowed through the Sylvan fissure, forming a clot which extended along the median line from a point anterior to the optic chiasm to the posterior border of the pons, and was a thick sheet over the left lateral half of that commissure. The hemorrhage was entirely derived from a single laceration which largely excavated the temporal lobe, and broke through the cortex at only a single point. The brain was moderately hyperæmic and œdematous.

The interpretation of the respiratory phenomena of this case is simple. The infrequent respiration on admission was due to primary cortical hemorrhage reaching the medulla, and the effect was transient because the pressure was relieved by the onward passage of the blood before coagulation. The final sudden cessation was the result of a renewed extension of hemorrhage over the medulla at the moment of death which again drained away into the occipital fossa.

Case LIII.—*Late Respiratory Failure from Ventricular Hemorrhage. Necropsy.*—Patient fell down stairs and was at once admitted to hospital; no external injuries; coma; temperature 97.4°; pulse 60; respiration 16; hemorrhage from right ear, nose, and mouth; head and eyes turned to the left, pupils symmetrically dilated and without reaction, patellar reflexes exaggerated; muscles of both upper and lower extremities spastic, more marked on right side; loss of rectal and vesical control.

Later history: coma; muscular spasticity, loss of rectal and vesical control, and deviation of eyes to the left which continued

until death on the third day. The pupils became contracted but were still without reaction, and the right radial pulse was fuller and stronger than the left, on the second day; and the respiration was Cheyne-Stokes on the third day; temperature on the second day was 97.4° to 102°, and on the third day 101° to 103°. The respiration just before death rather suddenly fell to 5 to 4 in the minute.

*Lesions.*—Fracture extending from right occipital fossa through groove for lateral sinus, and petrous portion of temporal bone; complete excavation of left frontal lobe, and laceration of right occipital lobe. Cortical hemorrhage over left anterior parietal region; fluid blood filled lateral ventricles and escaping through fourth ventricle formed clot upon the medulla.

CASE LIV.—*Gunshot Wound of the Brain with Immediate Death. Lesions.*—Bullet of 0.32 calibre furrowed base of frontal lobe, passed obliquely inward and backward, perforated temporal lobe between first and second convolutions, and perforated dura mater, fractured squamous portion of temporal bone, and fell back into the cerebral cortex; no epidural hemorrhage; cortical hemorrhage confined to the basal furrow and to anterior surface of pons and medulla.

(To be continued.)

# SKIN GRAFTING AT THE JOHNS HOPKINS HOSPITAL.

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THIS paper is based on a review of 544 house cases which have been skin-grafted in the clinic of Dr. Halsted at the Johns Hopkins Hospital. In this series all types of grafts have been used, and skin defects on almost every part of the body have been grafted.

*Technic for Thiersch Grafting: Preparation of the Skin from which the Graft is to be Cut.*—Shave the selected area and scrub carefully with green soap and water, and rinse with water. Sponge with ether, followed by 70 per cent. alcohol; then with Harrington's solution (bichloride of mercury, 9 gr.; hydrochloric acid, 60 c.c.; water, 330 c.c.; alcohol, 600 c.c.) and finally wash thoroughly with bichloride of mercury solution 1 : 1000. Again wash carefully with sterile normal salt solution, and apply a sterile gauze dressing, wet with normal salt solution until ready to cut the graft. (When Harrington's solution is omitted use 95 per cent. alcohol and continue as above.) The grafts are almost always cut from the thigh, and usually from the right one when practicable. The anterior and inner portion is the first choice, the external aspect next, and finally, if necessary, the posterior portion. Occasionally the skin from the arm or leg is used.

*Cutting the Graft.*—Place a small sand-bag beneath the thigh in order to give a better surface from which to cut. Arrange the usual sterile dressings about the selected area. Care must be taken that no carbolic or bichloride solutions be brought into the field or touch the grafts, either on the dressings, gloves, or instruments.

The Catlin knife and the boards after being boiled are

placed in salt solution, and the sterile rubber protective is removed from the bichloride solution, and also put in salt solution.

The skin wet with salt solution is then put on the stretch, and held as flat as possible by means of two sterile boards about 8 inches long, placed quite close together at right angles to the length of the limb, the first being held by the assistant, and the other by the left hand of the operator.

The edge of the sharp Catlin knife is then engaged in the skin between these boards and held almost flat against the limb (Fig. 1), and by a rapid sawing motion the graft is cut, the knife closely following the board in the hand of the operator, which is drawn slowly along in front of it (Fig. 2). The graft is cut at a level which will include the tops of the papillary layer of the corium, and only a slight amount of bleeding will follow.

After cutting the graft, it is picked up upon a piece of rubber protective, the raw surface being exposed. The whole is then placed upon a board and by means of a smooth instrument the graft is spread out evenly (Fig. 3). It is then covered with gauze wet in salt solution until the area to be grafted is ready. For several years the large grafts on the defects following operation on breast cases have been buttonholed here and there to get rid of air bubbles.

*Application of the Graft.*—Being sure that all bleeding has ceased, the protective on which the graft is spread is placed over the defect so that the graft is next to the wound. Then gradually the protective is lifted up and the graft is separated and left in place. It is pressed down evenly on the wound with pieces of gauze in order to get rid of any air bubbles, and to make it adhere as closely as possible. Should more than one graft be needed, they are placed so that they slightly overlap the edges of the wound and of the adjacent grafts.

*Preparation of the Surface to be Grafted.*—If the graft is to be applied to a clean fresh wound it is important to see that all hemorrhage has ceased, and that the wound is as dry as possible. If a granulating wound is to be grafted, it is

only necessary that the granulations be in a perfectly healthy condition before the grafting is attempted.

In a few cases the grafts have been applied directly to the healthy granulating surface after cleansing this surface as thoroughly as possible with irrigations, gauze pledgets, and wet compresses, being careful not to cause any bleeding. Lauenstein's method of rubbing off the granulations with sterile gauze tampons has also been used, but usually the granulations were thoroughly removed with a curette or scalpel down to the firm base, and the grafts applied. In addition to the above the unhealthy skin edges were excised and gridiron incisions made through the hard fibrous base of the ulcer to healthy tissue beneath, extending out into the normal surrounding skin, in order to obtain a better blood supply. In some old chronic ulcers the entire ulcer, including edges and base, was excised down to healthy tissue and the graft then applied.

*Dressing of the Grafted Surface.*—Since April 10, 1895, when sterile silver foil was first applied in this hospital as a dressing to the grafts, it has been used almost exclusively, and with excellent results. It is put on in several layers and over the last layer are placed the porous sheets of paper which come between the silver leaves. This dressing allows the secretions to come through and be absorbed by the gauze which is placed above it. The dressing is secured by a bandage and the part immobilized. The first dressing takes place ten days later.

*Dressing of the Area from which the Graft is Cut.*—All sorts of dressings have been tried, but the one finally adopted as the most satisfactory and comfortable is sterile boric acid ointment spread on sterile rubber protective. This dressing extends some distance beyond the margins of the wound and is held in place by strips of adhesive plaster, and over this is put a dry sterile gauze dressing and a bandage.

By the method above described the largest and most satisfactory grafts can be cut, but this requires a skilful hand and constant practice.

In the following statistics I have used this classification:

FIG. 1.

The boards in place, close together, holding the skin flat and on the stretch, with the Catlin almost flat against the thigh.

FIG. 2.

The graft being lifted up as the cutting proceeds, and the knife following closely the board in the left hand of the operator, the other board remaining in its original position.

FIG. 3.

The graft being spread out, raw surface uppermost, on a board covered by rubber protective.

*autodermic,* where the graft is obtained from the same individual; *isodermic,* where the graft is obtained from another individual of the same species; *zoödermic,* where the graft is obtained from a lower species.

In the cases reported here, the large majority have been those in which it seemed best to use thin grafts, this being especially called for in covering the defect in the skin left by a complete breast operation. Most of the grafts were obtained by the modified Thiersch method as described above; a few by Reverdin's epidermic method; and one or two by Lusk's blister method. Comparatively few thick grafts have been used, only 21 cases in all, 12 being whole-thickness sessile flaps, and 9 whole thickness pedunculated living flaps, from a distant part. Sliding plastic flaps from the adjacent skin were used when possible, and the defect immediately covered with a Thiersch graft. A number of cases have been grafted in the out-patient department whose records I have been unable to obtain.

The ulcers following breast operations were allowed to heal by granulation until July 6, 1896, when one was grafted for the first time by Dr. Bloodgood. On October 5 of the same year a partial immediate graft was tried at the time of the operation, also by Dr. Bloodgood; and since that time practically every defect following a breast operation in which the skin edges could not be approximated has been grafted with a complete immediate graft.

The graft was spread on protective first on March 7, 1896, which procedure greatly facilitates placing it in position. The attempt is always made to cover the defect with a single graft, consequently very large single grafts have been cut. The notes on the measurements of both defects and grafts to be covered are very incomplete, but the following taken after cutting may be mentioned: 8 x 10 cm., 8 x 12 cm., 8 x 16 cm., 10 x 18 cm., 12 x 12 cm., 16 x 16 cm., and 15 x 16 x 14 cm. (irregular shape). Results show that these larger grafts take as well as the smaller ones. Size of defect to be covered: 8 x 10 cm., 10 x 10 cm., 10 x12 cm., 11 x 11 cm., 12 x 12 cm., 12 x 14 cm., 14 x 14 cm., 15 x 15 cm., 20 x 20 cm., and 19 x 23 cm.

Thin Thiersch grafts of uniform thickness take better than those of varying thickness. Large grafts cannot be cut from a fat or flabby thigh.

Several recontractions have taken place under Thiersch grafts, especially those placed on the palm of the hand, and there seems to be no doubt but that a whole-thickness graft in this and other exposed locations would be more satisfactory.

Several cases of phlebitis of the long saphenous vein followed cutting grafts from the left thigh; and for this reason the right thigh is used whenever practicable, no case of phlebitis having yet followed cutting on this side.

In quite a number of cases black Thiersch grafts have been placed on white patients, and white grafts on black patients, with fair results. The pigment disappears or appears after a comparatively short time in Thiersch grafts, but there is no case in our series which will show the effect of the pigmentation of a whole-thickness graft thus transplanted.

When more skin than was required was cut, in several cases it was grafted on the wound from which it came with complete take.

What seems to be a failure at the first dressing will sometimes turn out very well, and *vice versa*. Some grafts are moist and there is considerable secretion throughout the healing process, while others are perfectly dry. In the moist variety a strong characteristic glue-like odor is often noticed. This moisture is probably due to secretions which are held back by the silver foil and paper, which becomes saturated soon after the operation, and then dries and forms an impermeable dressing, preventing the further escape of the secretions and also the ingress of air. Any one who has dressed grafted wounds covered with silver foil and paper will have noticed this fact in many cases, while in others the secretions do pass through and leave the wound dry. This latter is especially noticeable in those instances where alcohol is not used to moisten the paper in order to make it adhere more closely. In fact if the paper is used at all on these cases, which is unnecessary, it should not be moistened with

the alcohol, both for the reason mentioned above, and also because the alcohol is injurious if it should soak through to the graft. It is best therefore to omit the paper and alcohol and to place dry gauze immediately next to the foil.

Too much pressure of the dressing on the grafted area may cause sloughing of the freshly applied graft, and a heavy dressing, causing too much heat and sweating, is to be avoided. In the majority of cases the wound caused by the cutting of the graft is healed some time before the patient is ready to leave the hospital.

In this series I have counted as a single case all the grafting done on any one patient during that particular hospital admission. For instance, if the patient is grafted two different times, or has two defects grafted at the same time, both being complete takes, then this is called one complete take.

Should one graft completely take and the other partially take, then this would go under complete and partial takes, etc.

GENERAL SUMMARY.—Taking a general summary of the cases grafted we find that there were 286 breast cases, 88 leg ulcer cases, 85 miscellaneous ulcer cases, 76 contraction cases, and 9 defects following excision of keloids, etc., making a total of 544 cases, of which 383 were females and 161 males. The average age of the complete takes was 42 years, the youngest being 3 years and the oldest 79 years.

*Variety of Grafts.*—497 autodermic Thiersch, 13 isodermic Thiersch, 10 autodermic and isodermic Thiersch, 11 autodermic whole-thickness sessile flaps, 6 autodermic whole-thickness living flaps from distant parts, 3 autodermic Thiersch and living flaps from distant part, 1 autodermic Thiersch and whole-thickness sessile flap, 1 autodermic Reverdin and isodermic Thiersch, 1 autodermic Thiersch and Reverdin and isodermic Thiersch, 1 zoödermic, from dog. Altogether there were 40 cases in which isodermic Thiersch grafts were applied; 19 were complete takes, 16 were partial takes, and 5 were failures, thus showing that isodermic grafts are on the whole well worth trying. Nineteen thick grafts from distant parts

were used: 10 whole-thickness sessile flaps, with 9 complete takes and 1 partial take; and 9 living flaps, with complete take of all of these.

*Dressings.*—Silver foil, 442; 52 gauze, wet with normal salt solution, covered by rubber protective; 21 rubber protective and dry gauze; 2 gauze, wet with bichloride; 1 olive oil and protective; 1 collodion and protective; 25 not stated.

*Result of Grafting.*—Complete takes, 341; 168 partial takes; 14 complete and partial takes; 1 partial take and failure; 3 complete, partial take, and failure; 17 failures.

*Condition when Discharged from the Hospital.*—Healed, 412; 115, with granulating wounds, for the most part small; 13, no discharge note; 4, died.

Using the 69 partial-take breast cases as the base number, we find that the average length of time in the hospital after operation, of breast cases with complete take of immediate skin graft, is about 20 days; of partial-take immediate graft is about 28 days; and where no graft was used about 35 days. The 69 complete takes were all discharged healed. Of the partial takes, 22 cases were healed, 44 cases had small granulating wounds, in 3 cases the result was not stated. Where there was no graft the great majority were discharged with a fairly large granulating area. These figures show that grafting such cases, even if not completely successful, hastened considerably the healing process.

*Conclusions.*—The general health of the patient must be taken into consideration when skin grafting is contemplated, and grafts to be successful must only be transplanted to healthy wounds. As a rule grafts do not take well on luetic individuals. No antiseptics must touch the flaps before or after cutting. A general anæsthetic is necessary in the majority of cases where large grafts are removed. It is best to cover the defect with a single large graft if possible, as the healing is just as satisfactory as if several small flaps were used, and the scar is much less. Silver foil immediately over the graft has proved its worth, but it is best to apply it without the paper and not to use alcohol. Temporary moist salt gauze dressings are also very satisfactory.

Grafting, even if only partially successful, in the majority of cases will shorten the time in the hospital and accelerate final healing. Partial grafting nearly always stimulates epidermal growth from the edges of the wound.

Autodermic grafts take somewhat better than isodermic, but isodermic grafts are much more successful than is generally supposed. When a black superficial graft is applied to a defect on a white person the pigment disappears sooner or later, and *vice versa*. The majority of Thiersch grafts, especially on breast cases, that I have examined were still adherent throughout the greater part of their extent. The shrinkage in the size of a wound after grafting is in some cases quite remarkable.

Contraction is prevented to a large extent by grafting, although it sometimes occurs, especially under Thiersch grafts on exposed positions, such as the palm of the hand. In such locations the whole thickness of the skin should be transplanted. Slough of the axillary flap in breast cases has little effect on the healing of the grafts, as in many of the complete takes there was slough of the flap, and in many of the partial takes there was no slough. Mild wound infection, such as pyocyaneus, seem to have little effect on the ultimate healing of the graft.

# CYST OF THE ROUND LIGAMENT OF THE LIVER.

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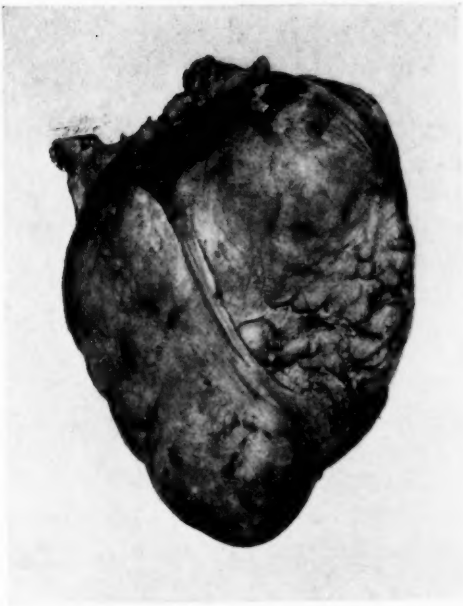
AFTER a somewhat superficial search through the literature for data on the subject, the following report of a case is thought worthy of recording on account of its apparent rarity. Comparatively speaking, numerous references have been found of cysts of the round ligaments of the uterus but none of cysts of the round ligaments of the liver. This case is the only one of the kind that has been met with in the Mayo Clinic at St. Mary's Hospital.

E. A. M., male, aged 41, presented himself for examination January 13, 1909. His complaint was the presence of an abdominal tumor. The following history was given.

One morning, about eight years before, on attempting to straighten up after stooping to lace his shoes, he was seized with a violent cramp in the region of the umbilicus. He was unable to stand erect on account of the excruciating pain, and had considerable difficulty in getting to his bed. The pain gradually lessened, and after a good bowel movement, the result of an enema, he was free from discomfort. There was no nausea and no vomiting during the attack. This attack was the only one of the kind that he had; but his business affairs were exacting and his general health began to fail. Symptoms at this time were indefinite; he was treated for neurasthenia, and soon after, while being examined by his physician, an abdominal tumor about the size of a lemon was discovered, the exact nature of which was doubtful. Laparotomy was advised, but deferred. Under treatment for his nervous condition he improved, was able to resume his business, and as the tumor gave him no discomfort the operation was put off from year to year. The tumor gradually increased in size, however, until at the time of our examination it was about the size of a head.

FIG. 1.



Cyst of the round ligament of the liver.

Physical examination showed a rather thin, dark complexioned man. Heart and lungs negative, as were also the blood and urinary findings. On palpation of the abdomen a freely movable fluctuating tumor was to be felt. When left to assume the natural position, it was seen to be just to the right of the umbilicus and a little below it. It was not tender, there was no tympany over it, and it did not move with respiration. The movement downward was more limited than the upward and lateral movements, as it could be easily placed in either flank or be pushed up beneath the liver. A positive diagnosis could not be made, but an exploration was advised and accepted.

*Operation,* February 12, 1909, by Dr. W. J. Mayo: A median incision below the umbilicus was made, and upon opening the peritoneal cavity a straw-colored thin-walled cystic tumor about the size of a child's head presented immediately beneath the abdominal wall. The tumor was anterior to the omentum which was found tucked up behind it. Putting in the hand to explore for the site of the attachment, it was found to be intimately associated with the abdominal wall, just above the umbilicus. The incision was accordingly elongated to two inches above the latter, by which means the cyst could be partially delivered outside the abdomen. Gauze dissection was used in freeing it from its pedicle, causing very little hemorrhage, as there were no vessels of any size running to it. It was then seen that the cyst had its origin in the lower two inches of the round ligament of the liver, where the latter is closely attached to the abdominal wall. The cyst was removed without rupture. A photograph was taken which is shown herewith (Fig. 1).

The patient's recovery was uneventful. He left the hospital on the twelfth day, and for his home in three weeks from the time of operation.

# HOUR-GLASS STOMACH.*

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ALTHOUGH twenty years have elapsed since Bardeleben reported the first operation for the relief of hour-glass stomach, and nearly 200 operated cases have been recorded in the literature during this time, the obscurity often attached to the diagnosis, the difficulties to be overcome in the presence of marked adhesions and distorted anatomical relations and the final solution of the problem by applying the correct operative procedure, afford sufficient reason for calling the attention of this society to a single case which, in part at least, was of my own making.

N. T. Female, aged 33, was admitted to the General Memorial Hospital in the service of Dr. Wm. B. Coley (to whom I am indebted for the privilege of operating upon and reporting the case) December 11, 1906, with a typical history of acute perforating gastric ulcer. Operation seven hours after perforation. The opening, an unusually large one, was situated on the anterior surface of the stomach, midway between the lesser and greater curvatures, about five inches from the pylorus. It was surrounded by a thickened indurated area, one and one-half inches in diameter. The size of the opening (which would easily admit the tip of the index finger), the induration and the favorable location, made this seem an ideal case for excision, and, accordingly, an elliptical area measuring about three by two inches was removed. The incision was closed with chromic gut in the usual way, transversely to the long axis of the stomach. The suture line extended up to but did not encroach upon the lesser curvature. The abdominal cavity was not flushed, but a small pocket containing mucous and gastric contents situated between

* Read before the New York Surgical Society, April 28, 1909.

coils of intestine and omentum just to the left of the median line was swabbed out and a cigarette drain introduced through the lower angle of the wound. Drainage removed on fifth day. Wound healed without suppuration. The patient made a good recovery and at the time of her discharge from the hospital, January 17, 1907, had gained eleven pounds in weight. She soon resumed her work (that of a housemaid) and continued in excellent health, weighing, in July, 1908, 149 pounds.

During the September following, that is three months less than two years after the operation, she began to suffer from "gas in the bowels" which was accompanied by a dull pain coming on about two hours after eating and extending from the left hypochondrium down to the umbilicus. Eating meat caused exaggeration of the pain and was usually followed by vomiting. These symptoms became progressively worse, and her decline was as rapid as had been her gain following operation. She was re-admitted to the hospital October 8, weighing 130 pounds. Lavage, dieting, and rest in bed, afforded slight relief to the symptoms, but did not check the loss in weight which had fallen during the subsequent three weeks to 117 pounds. Dr. Harold Barclay examined the stomach on four occasions during these three weeks with the following results:

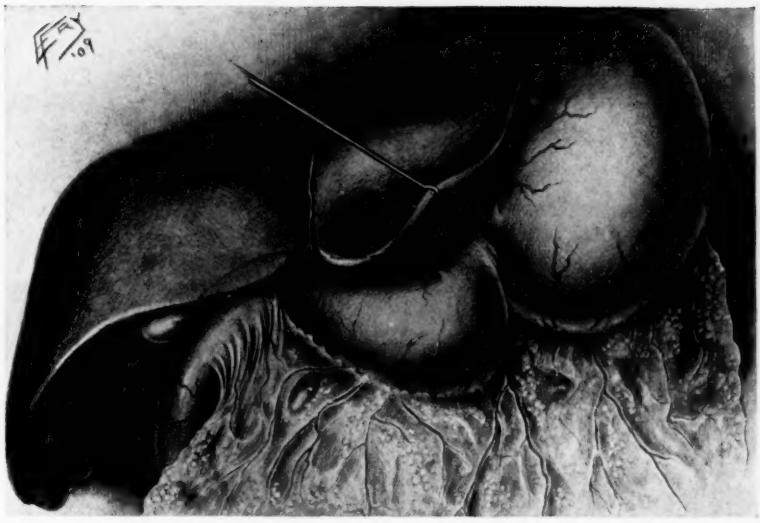
Upon distention an unusually large cardiac portion could be readily mapped out, but the pyloric portion could not be distended. This was attributed to adhesions binding down this part of the stomach which in turn gave rise to the symptoms. On each of these occasions she had been given on the evening before a meal composed of a meat sandwich and from fifteen to twenty raisins. The washing at the first examination brought back 50 c.c. of stomach contents, consisting of meat and raisins. The washing at the second, as well as at the fourth examination, brought up nothing; at the third washing 120 c.c. were obtained. Hydrochloric acid present; no lactic acid. No blood in washings at any time. No tenderness in epigastrium. The possibility of hour-glass stomach was strongly considered, but "adhesions binding down the pylorus, with pyloric spasm" was thought to be the most likely diagnosis.

Operation, November 12, 1908. Gastrogastrostomy. Median incision from ensiform to the umbilicus. The greater omentum had been caught up on the abdominal wall at the site of the old

scar, and had to be cut across before the stomach could be exposed. Then a tumor could be felt involving the stomach and liver, which at first was thought to be cancer; but after completely exposing the stomach this mass was found to be composed of dense adhesions binding the anterior wall and lesser curvature to the under surface of the left lobe of the liver. A typical hour-glass stomach with a cardiac pouch about twice the size of the pyloric pouch, was disclosed (Fig. 1). The channel connecting the pouches would just admit the tip of the index finger plus the invaginated stomach wall. The cardiac pouch extended well up under the ribs and its wall was markedly thickened, while that of the pyloric portion was normal in appearance; the pylorus was not stenosed. The adhesion between the stomach and liver was so extensive and so completely organized, that it was out of the question to separate these structures; for this reason and the fact that the pouches could easily be approximated—in the presence of a patent pylorus—gastrogastrostomy was decided upon as the operation best suited to the case. This was easily accomplished with the aid of stomach clamps, and a three-inch vertical incision was so placed that the pouches communicated freely at their lowest points (Fig. 2). Convalescence rapid and uneventful. Discharged December 2, 1908, and returned to work four weeks later. At this writing, four months after operation, she weighs 146 pounds—a gain of 29 pounds—and can eat food of any kind without distress.

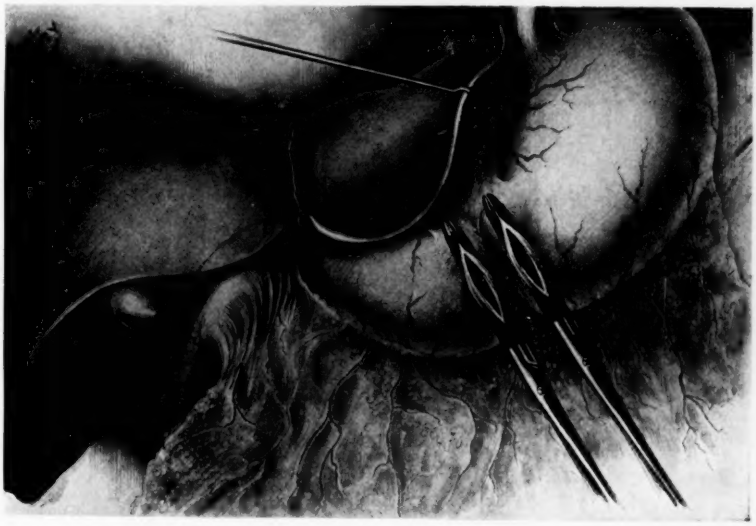
I feel that it is hardly necessary to venture the opinion that had posterior gastro-enterostomy been added to the original operation—and the patient could easily have stood it, the conditions requiring the second operation would not have arisen. As to the factors entering into the cause of the complication under discussion, not the least was the cigarette drain which had been so placed that it prevented proper descent of the omentum, with the result that this structure adhered to the abdominal wall throughout the lower half of the incision. In turn, the normal excursion of the stomach was limited, thus inviting the formation of perigastric adhesions. The constriction, involving, as it did, almost the entire circumference of the stomach at the junction of the middle and distal

FIG. 1.



Hour-glass stomach.—Margin of left lobe of liver retracted in order to show location and extent of the adhesion between liver and stomach.

FIG. 2.



Gastrogastrostomy.—Clamps in place. Openings formed, ready for suture.

thirds, was composed largely of cicatricial tissue which was undoubtedly just as important an element in the formation of the stricture as was the liver adhesion. Whether other ulcers were present and were overlooked at the time the one which perforated was excised, or the cicatrix resulting at the site of excision accounts for this scar tissue, I am unable to say. We know, however, from the writings of men best fitted to pass judgment on the subject, that ulcers which extend transversely to the long axis of the stomach, in the process of healing do lead to hour-glass stomach—in fact this is the most frequent cause. If you recall, the suture line in this case ran in that direction, and knowing, as we do, that any wound of the stomach or the intestine tends to contract, especially if in its closure a proper apposition of the mucous membrane is not obtained, I am therefore inclined to believe that the cicatrix was a factor in the formation of the stricture and that the suture line was wrongly placed. In the future, if I have occasion to excise an ulcer of the anterior wall, I shall make the incision parallel with and not transverse to the long axis of the stomach—as is the custom—first applying stomach clamps to control hemorrhage. I shall also dispense with drainage after operation in this region, except in the presence of an abscess or fistula, and then will see that the drain is so placed that it will interfere with the omentum as little as possible.

As to the second operation I am not sure, upon reflection, but that gastro-enterostomy would have just as well met the immediate indication and, at the same time, have been a safeguard against the recurrence of ulcer.

*Frequency.*—That hour-glass stomach is not of infrequent occurrence, is shown in every large series of cases of ulcer of the stomach examined both at autopsy and on the operating table. Grünfeld of Copenhagen, quoted by Veyrassat,[1] found the stomach to be the seat of an old ulcer in 124 out of 1150 autopsies, in 38—or 30 per cent. of which hour-glass contraction was present, the stenosis being too tight to admit the tip of the index finger in 8 cases. Moynihan[2] in 1905 re-

ported 198 operative cases of chronic ulcer of the stomach, encountering hour-glass contraction 19 times, or in 9 per cent.

In 925 operations for ulcer of the stomach and duodenum, W. J. Mayo [3] says they have found hour-glass contraction 31 times, or in 3.3 per cent. of the cases. This is by far the largest single series of operations for ulcer yet recorded and probably represents very accurately the frequency of this complication in this country at least.

*Etiology.*—It was formerly thought that a considerable proportion, if not the majority of cases of hour-glass stomach, was of congenital origin. That this contention is incorrect, however, has been proven conclusively by the findings at operation. Ulcer, either active or healed, perigastric adhesions or cancer have been present in every case. Mayo Robson [4] states that in over 500 operations on the stomach he has not met with a single case of congenital hour-glass contraction. Only one undoubted case has been reported, according to Moynihan. Gardiner [5] has recently added a case to the literature, being that of a child three months old, in whom the condition was found at autopsy. As stated above, ulcer, adhesions or cancer have been so consistently present at operation that we are justified in attributing all cases to one or the other of these causes. Ulcer, as Veyrassat has well said, dominates the pathogenesis of hour-glass stomach. It may act by contraction of the stomach wall during cicatrization, or by setting up adhesions with the abdominal wall or adjoining structures, or finally by predisposing to the development of cancer. When biloculation results from cicatrization, the ulcer has usually originated either in the anterior or posterior wall or in the lesser curvature at or near the middle of the stomach and has extended transversely to its long diameter. As a rule, the puckering is at the expense of the greater curvature, but Moynihan refers to two cases in which the opposite condition was present.

Perigastric adhesions may form bands which constrict the stomach, or, more commonly, a given point on the stomach wall may become so fixed to the parietes, liver or pancreas,

that biloculation will necessarily take place. These adhesions result in the majority of cases from an ulcer which has either perforated or extended down to the serous coat and become adherent to the peritoneum of adjacent parts. They may also follow injury or disease of adjoining structures, or operation involving this region. In the case herewith reported the adhesion to the liver was the direct result of operation.

Cancer implanted upon ulcer, or from whatever cause arising, situated at the points already mentioned, may lead to hour-glass stomach; however, again quoting Veyrassat, "this complication is merely an episode in the progress of the gastric neoplasm and is of consequence only as it concerns the treatment of that disease."

The constriction may be located in any part of the stomach, but most often involves the pyloric half, and, as a result, the cardiac pouch is the larger in the majority of cases. The relative size of the pouches and the thickness of their walls depend in a measure upon the calibre of the opening connecting them. A long, narrow channel results in a much dilated cardiac pouch with hypertrophied walls. If there is stenosis at the pylorus, which is not uncommon, both pouches become dilated and their walls thickened.

Robson and Moynihan[6] report two cases of double constriction forming a trifid stomach. One followed cicatrization of an extensive ulcer; in the other, an adhesion to the liver subdivided the cardiac pouch. The duodenum may also be the seat of hour-glass contraction. In the 925 operations for ulcer of the stomach and duodenum (about equally divided as to location), reported by W. J. and C. H. Mayo, hour-glass contraction was encountered 31 times—once in the duodenum and 30 times in the stomach. The same etiological factors no doubt prevail when the duodenum is the seat of this deformity as when it is located in the stomach, to which an added factor of no little importance would be periduodenal adhesions following inflammation of the gall-bladder and passages.

*Symptoms* of hour-glass stomach differ very little, if any, from those due to narrowing of the pyloric orifice. They

follow, as a rule, in due time the preceding history of gastric ulcer. Taken alone the symptoms give no clue to the diagnosis, but if considered along with certain characteristic physical signs, will lead to a correct diagnosis in the majority of cases. Moynihan [7] says of his first 6 cases that only 1 was correctly diagnosed; but of the last 9, 7 were diagnosed with certainty. Naturally the signs of most value are those obtained from washing out the stomach and by distending it with gas. The following classification of the usual signs is practically that of Moynihan:

1. If a known quantity of water is introduced through the stomach tube and only a part is returned, the missing portion must have passed into a second cavity (Wölfler's first sign).

2. If the stomach is washed until the fluid returns clear and in a short time is again washed with the result that the fluid is returned dirty and perhaps foul smelling, it is evident that regurgitation has taken place from some connecting cavity (Wölfler's second sign).

3. After washing out the stomach and apparently completely emptying it, a splashing sound may be elicited, due to a portion of the fluid remaining in the pyloric pouch (paradoxical dilatation of Jaworski).

4. Upon passing in a quantity of fluid there may be distention of the cardiac pouch which gradually subsides to be followed by bulging in the pyloric region (Von Eiselsberg).

5. If the two halves of a seidlitz powder are given separately, and the stomach is auscultated, no loud forcible sounds are heard in the normal stomach except at the pylorus; if, however, constriction is present, the same sounds may also be distinguished to the left of the median line( Von Eiselsberg).

6. Moynihan first called attention in 1902 to a sign which has since been of great assistance to him in making the diagnosis of hour-glass stomach. The abdomen is carefully examined and the stomach resonance percussed. A seidlitz powder in two halves is then administered. On percussing after about 30 seconds an enormous increase in the resonance

of the upper part of the stomach can be found, while the lower part remains unaltered. If the pyloric pouch can be felt or seen to be clearly demarcated, the diagnosis is inevitable, for the increase in resonance must be in a distended cardiac segment. If the abdomen be watched for a few minutes the pyloric pouch may be seen to fill and become prominent.

7. On distending the stomach with $CO_2$ a distinct sulcus may be seen.

8. Radiography following the administration of bismuth mixture, gastrodiaphany and such measures may be of value in obscure cases, but are unlikely to be necessary.

*The treatment* of this condition is, of course, surgical, and the essential feature of any operative procedure as applied to a given case of hour-glass stomach, is that it shall provide complete drainage; failing in this the result will not prove satisfactory.

A careful examination of the stomach and its surroundings, with a full understanding of the cause and location of the constriction, is necessary in every instance, before a final decision is reached as to which method to employ.

The following operations have been resorted to in the treatment of hour-glass stomach, and when applied to suitable cases, either singly or in combination, will afford the desired relief: Gastroplasty; gastrogastrostomy or gastro-anastomosis; gastro-enterostomy; partial gastrectomy (partial resection, annular mediogastric resection, pylorogastrectomy); dilatation. The dividing of adhesions has also been classed as an operation, and while it is apt to be a necessary adjunct to any procedure, may in a rare case of itself suffice.

*Gastroplasty*, an operation similar to pyloroplasty, was first used by Bardeleben in 1889. An incision, four or five inches in length, with its centre over the stricture, is made in the long axis of the stomach and is then closed in the opposite direction by two rows of sutures, the first including the entire wall and the second peritoneum and muscularis. Kammerer's[8] operation, a modification of the above, similar to Finney's operation for pyloric stenosis, is, according to Moynihan,

the better operation. The use of the stomach clamp in Kammerer's operation as recommended by Gould [9] in his modification of Finney's pyloroplasty, would be of distinct advantage. Gastroplasty is indicated, if at all, only in thin-walled movable stomachs. It is contra-indicated when marked induration and extensive adhesions are present, on account of the difficulty in approximating the pouches and in getting stitches to hold, in active ulceration because it does not put the stomach at rest, and in all cases where the pylorus is stenosed.

*Gastrogastrostomy* or gastro-anastomosis consists in forming a vertical opening between the two pouches, so arranged that free communication will be established at their lowest points. The use of the stomach clamp has greatly simplified the technic of this operation, and, like gastroplasty, it is easy of execution, but has distinct limitations. It is permissible only in those cases in which the pouches are relatively large and sufficiently dependent to permit of their being easily approximated. As in gastroplasty, the pylorus must be open and the stomach free from active ulceration.

*Gastro-enterostomy* (posterior) should be the operation of choice in hour-glass stomach, for it best fulfils the essential requirement—drainage. Besides, by giving the stomach rest, active ulcers heal, and the chance of a recurrence is minimized. The anastomosis should be formed with the cardiac pouch, and only in those cases with co-existing pyloric stenosis is anything further necessary. In these it may be combined with either gastroplasty or gastro-anastomosis, or the suggestion of Weir and Foote [10] to unite each pouch to the jejunum by separate openings, may be adopted. In a number of instances on account of failure of the surgeon to properly examine the stomach before proceeding with gastro-enterostomy, death has followed as the result of forming the anastomosis with the pyloric pouch—that is distal to the obstruction. It may be permissible in rare cases where the stricture is high up in the cardiac half of the stomach to form the anastomosis with the pyloric pouch after manually dilating the stricture. Blake [11] reports such a case in which the result was excellent.

*Partial gastrectomy* is a more formidable operation than the preceding and should be reserved for those malignant cases in which a radical operation is justified and for indurated ulcers of a doubtful nature.

*Dilatation* is not a procedure to be recommended and should only be resorted to when, on account of adhesions or location of the stricture, other methods are impossible.

### RESULTS.

All the cases reported up to August, 1908, have been collected by Veyrassat, with the following result:

*Gastroplasty:* 48 cases—36, or 75 per cent., cures; 7, or 14.6 per cent., failures; 5, or 10.4 per cent., deaths.

*Gastrogastrostomy:* 22 cases—15, or 68 per cent., cures; 3, or 13.6 per cent., failures; 4, or 18 per cent., deaths.

*Gastro-enterostomy:* 73 cases—57, or 72 per cent., cures; 2, or 2.7 per cent., failures; 14, or 19.1 per cent., deaths.

Six of the 14 deaths following gastro-enterostomy resulted from an error in technic—the intestine being united to the pyloric pouch.

RADICAL METHODS.—(a). *Partial resection.* 3 cases—1 cure; 2 deaths.

(b). *Annular mediogastric resection:* 12 cases—11, or 91.7 per cent., cures; no failures; 1, or 8.3 per cent., deaths.

(c). *Pylorogastrectomy:* 2 cases—no deaths.

COMBINED OPERATIONS: 21 cases—4, or 19 per cent., deaths.

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# DIAGNOSIS AND TREATMENT OF CARCINOMA OF THE CÆCUM.*

WITH A REPORT OF TWO CASES TREATED BY RESECTION OF THE CÆCUM.

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IN May, 1901, I published in *American Medicine* a report of a case of carcinoma of the cæcum, operated upon April 11, 1900. In condensed form the report was as follows:

CASE I.—The patient was a woman of 38 years who gave a history of dyspepsia and failing health dating back some months. She had lost 40 pounds in weight, and was suffering from colicky attacks, with constipation becoming more and more pronounced. Five weeks before presenting herself for operation she first noticed in the right side a tumor which gradually enlarged. Upon examination a movable nodular mass, roughly the size of a split orange, could be grasped between fingers and thumb and pushed to the umbilicus or up into the right hypochondriac region under the free border of the ribs. Usually it lay in the right lower quadrant of the abdomen and had previously been mistaken for an inflammatory mass due to appendicitis, or a floating kidney.

Through abdominal incision, three inches long, in the median line, the tumor was delivered and found to be a carcinoma at the ileocæcal junction, mainly involving and nearly filling the cæcum. The head of the cæcum was invaginated, resembling a glove-finger pulled into itself as the finger is withdrawn, almost concealing an unusually long appendix. The omentum and mesentery were free, excepting a few mesenteric nodes which were found enlarged and were dissected out.

Gauze strips were passed through the mesentery around the ileum, about 4 inches from the cæcum, and around the large gut at the junction of the cæcum and ascending colon, and the strips tightened to control the circulation and occlude the lumen of the intestine. The tumor-bearing portion of intestine was then cut bodily from the mesentery, all vessels being caught and tied separately. The cut ends were closed by a Murphy button anastomosis of the ileum and transverse colon, made through a longitudinal slit in the transverse colon about 5 inches from the closed end of the ascending colon. The anastomosis was reinforced with an additional row of interrupted silk sutures. The peritoneal cavity was cleansed by irrigating with normal salt solution, and the abdomen closed.

* Read before the Pathological Society of Rochester, N. Y., December 8, 1908.

The patient was given half-pint normal salt solution enemas every six hours till flatus was passed. The bowels were moved on the fourth day, and thereafter food was given sparingly for a week. The button was passed on the sixteenth day, and three weeks after the operation the patient went home.

The tumor and nodes were examined by Dr. H. U. Williams, Professor of Pathology, University of Buffalo. He reported the neoplasm to be an adenocarcinoma of colloid type. The enlarged nodes were not the result of metastasis, but were inflammatory and no doubt due to septic absorption from the fungoid ulcerating surface of the tumor within the bowel lumen (see Fig. 1). The tumor itself is about the size of a lemon. The specimen is in the Army College Museum.

April, 1909.—Since her recovery she has regained and has maintained her health and weight, and has borne two children in the nine years since the operation.

Case II.—Mrs. C., mother of three children; menopause at 45. Was 56 years old in August, 1907. Family history good. Health good until December, 1906, when her appetite became poor and bowels constipated. In July, 1907, she began to lose weight and fell away gradually till I saw her September 25, 1907, losing in all 20 pounds. In the early summer she discovered a lump in the lower abdomen. The constipation became more marked and she often had colicky pain with rumbling of gas. The lump grew larger slowly.

On examining Mrs. C., I found her anæmic and emaciated. Her heart and kidneys were not affected. The abdomen was distended in the right lower quadrant and peristaltic waves in intestinal coils moving toward the cæcal region were plainly seen. A mass somewhat irregular in outline and about the size of an orange was plainly felt in the right inguinal region, and on pressure the patient complained of tenderness.

On September 30 I operated, incising in the outer edge of the right rectus and exposing a freely movable tumor of the cæcum which was delivered onto the abdominal wall through an incision 4 inches long. The colon at the junction of the cæcum and the ascending colon having been clamped, the cæcum was cut away. Now the ascending colon was occluded by purse-string and inversion of the cut end. The same procedure was next done on the ileum about 3 inches from the ileocæcal junction. I then freely cut into the mesocæcum and mesentery, removing a wide triangular flap and removing all lymph-nodes which were demonstrable. I next made a lateral anastomosis between the blocked ends of intestine an inch from the closed ends. No drain was used. The patient made a good recovery, disturbed only by a subcutaneous abscess and cellular infection of colon bacillus type. She is at present (July, 1909) in good health and has gained 18 pounds within 22 months after operation.

Dr. H. U. Williams examined the tumor and pronounced it an adenocarcinoma of colloid type, mesenteric nodes showing no metastasis. He has mounted it for the college museum (see Fig. 2). The tumor was about the size of an orange.

In both tumors, proliferation of the neoplasm occurred mostly

within the lumen of the cæcum, nearly filling the cavity of the gut and distending it to make a mass nearly as large as an orange. A rod as large as a lead pencil found its way with difficulty through the tortuous channel still present in each ileocæcal valve and the lumen of the cæcum itself. The rod shows in each figure.

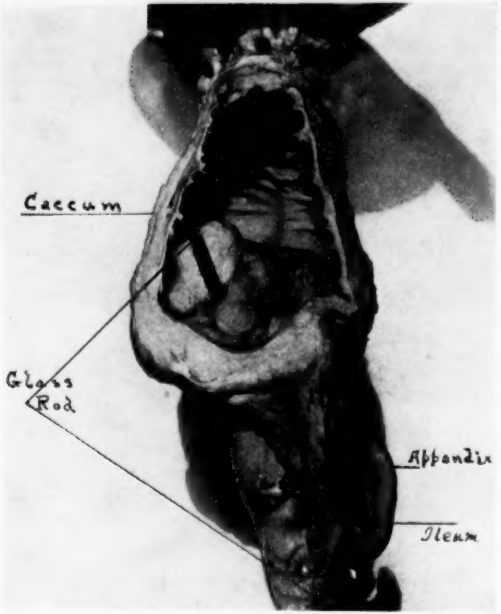
Cumston and Vanderveer collected 79 cases of cancer of the cæcum which they reported with 2 cases of their own, one being reported by each writer, in the ANNALS OF SURGERY for January and February, 1902. Of these operations 4 were exploratory openings of the abdomen. Excluding these exploratory operations, 33 of the remainder resulted fatally and 44 of the patients recovered—some with an artificial anus. The statistics of these operations in the years just preceding the publication were noticeably better than those of the earlier surgical periods.

Cumston and Vanderveer discuss entero-anastomosis after resection of the cæcum at length in their article, paying special attention to methods of enterorrhaphy to approximate the large open colonic end to the smaller open end of the ileum.

To me it seems wiser and easier to occlude the colonic end and make the lateral implantation of the ileum into the colon already described in Case I, or still better, to close both ends and make a lateral anastomosis between the blocked ends, as in Case II. A better circulation is insured by these methods for the anastomosis. Each cut edge of mesentery is free to recover its circulation, eliminating the so-called " dead space " at the mesenteric border which leads to leakage in end-to-end anastomosis. At the site of the anastomosis, a far better circulation is insured by either method. In the implantation only the cut end of bowel has had its mesenteric circulation impaired, and danger of leakage is lessened, while in a lateral anastomosis leakage occurs only as a fault in technic.

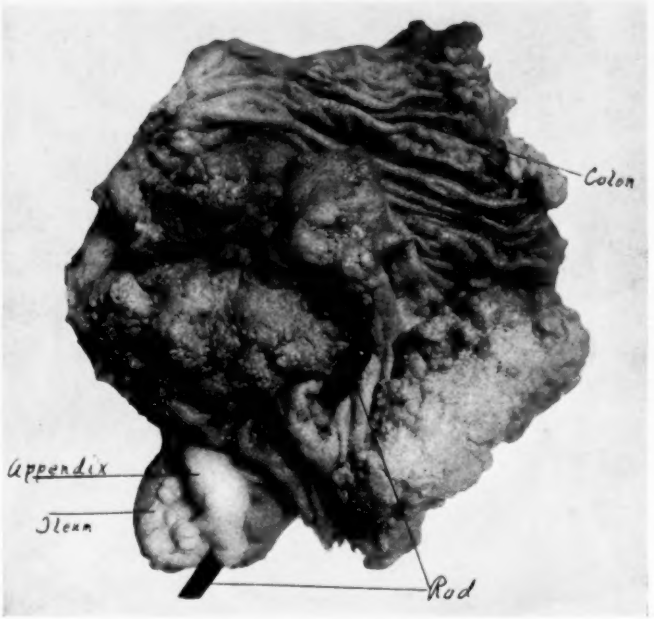
In cases of irremovable cancer of the cæcum, an ileo-sigmoidostomy or ileocolostomy is indicated to " short circuit " the diseased area, if bowel obstruction is imminent or present. If operation is done for patients suffering from obstruction of the bowel due to cancer of the cæcum when the patient's condition is such that a resection or a short circuiting by lateral anastomosis for irremovable cancer cannot be done at

FIG. 1.




CASE I.—Carcinoma of cæcum. From specimen in Medical College Museum. (Photograph by James A. Gibson, M. D.)

FIG. 2.




CASE II.—Carcinoma of cæcum. From specimen in Medical College Museum. (Photograph by James A. Gibson, M. D.)

the time, an artificial anus can be made. This procedure should only be considered, however, as a matter of necessity and a future operation to short circuit the disease and close the artificial anus should be done, if possible.

In reporting their own cases, Cumston and Vanderveer own to a diagnosis of appendicitis in one of them and to an exploratory laparotomy in the second—diagnosis being uncertain. Cumston removed the appendix in his case, and eight weeks later again operated to attack the true disease that had made itself more manifest by symptoms of bowel obstruction and palpable tumor. Vanderveer made an exploratory laparotomy to make his diagnosis which was obscured by the abdominal distention of complete bowel obstruction.

In discussing symptomatology, I include with the two operated cases three cases of inoperable cancer of the cæcum which I saw in consultation when too far advanced to be removable and which were not in need of operation to relieve obstruction.

In all my cases pain of a colicky nature due to mechanical interference with peristalsis, and most severe in the lower right side of the abdomen, occurring on several occasions, had caused the attending physicians to diagnose chronic appendicitis. In the first case a floating kidney was later diagnosed, when the large movable tumor was found.

In all of the cases the characteristic group of symptoms were loss of appetite, impaired digestion, loss of flesh and color, occasional diarrhœa, and, later, constipation increasing in obstinacy, accompanied by colicky pains most severe in the right lower quadrant of the abdomen. The patients had a low-grade septicæmia, temperature occasionally reaching 99.5 or 100° F.; slow pulse early in the course of the disease, and faster as weakness became more pronounced; no chills or sweats; hæmoglobin low.

Indicanuria, when present, is an indication of obstruction of the bowel, when considered with the symptoms already given. In Case II Dr. Abbott made two examinations of the urine before operation,—one six months before and one a few days before operation. Both showed indican increased. Re-

peated examinations since operation show no increase of indican.

No blood examination was made in Case I, but in view of the ulcerating interior of the tumor mass and the inflammatory lymph-nodes, a moderate leucocytosis could be readily explained, although a secondary anæmia was to all clinical appearance the most likely blood condition. In Case II, just before operation, Dr. Abbott found hæmoglobin 65, red cells 3,500,000, and leucocytes 8500—no differential count being made.

In none of my cases could a history of bloody or mucous stools be obtained; but it must be remembered that careful observation of evacuations is rarely made by patients. Dr. Abbott reports no blood found in his examination of the stool in Case II just prior to operation.

These signs and symptoms can be grouped under two headings: those of a low-grade septicæmia plus the toxæmia of intestinal putrefaction, and, secondly, those of increasing mechanical interference with peristalsis—that is, obstruction of the bowel.

Upon the discovery of a tumor the signs and symptoms just considered take on new significance. We may be dealing with tuberculosis of the cæcum, impaction of fæces, floating kidney, tumor of the kidney, chronic appendicitis, distended gall-bladder, or ovarian tumor. Cumston and Vanderveer mention also gastrectasis, gastroptosis, and carcinoma of the stomach. The picture of cancer of the cæcum heretofore given may be clear enough to make a differential diagnosis easy in many cases. In some, exploratory incision may be necessary to determine the diagnosis.

The length of time elapsing before the tumor mass actually does become palpable bears strongly on prognosis. Careful physical examination is often overlooked by physicians, or the new growth would be discovered earlier, beyond doubt, than actually does occur in most cases. In scirrhus forms of cancer the tumor may be progressive for many months before it becomes palpable or visible; or it may not be found till exploratory operation is done, or after death. In colloid forms

it may appear much earlier,—within two months from the onset of symptoms, as in Case I, or within five or six months, as in Case II.

Cancer of the cæcum has come under my observation much less frequently than cancer of the sigmoid flexure or of the rectum. I have had 5 cases, of which 2 were operable and removable and are herein reported. My colleague, Clinton, has seen 3 cases, 2 advanced and inoperable and 1 which recovered after resection of the cæcum with end-to-end anastomosis of ascending colon and hypertrophied and distended ileum. The resection was done eight months ago, and the patient is at present in good health.

Sutton says carcinoma is more frequent in the lower than in the upper part of the intestines. In every 100 cases of intestinal cancer, according to him, 75 occur in the rectum, 23 in the large intestine and 2 in the small. Of the 23 cancers of the large intestine, 2 occur in the cæcum, 3 in the hepatic flexure, 4 in the splenic flexure, 10 in the sigmoid flexure, and 4 elsewhere in the colon.

If 2 per cent. of cancers of the intestine are cæcal in situation we must admit the need of considering this disease in all cases of chronic disease of the right lower quadrant of the abdomen. The earlier the diagnosis the more hopeful is the outlook after resection. My result in Case I is most encouraging, nine years of elapsed time being a most convincing proof of the complete removal and cure in this case of cancer of the cæcum.

All authorities agree that next to early diagnosis, surgical interference and wide and thorough operative removal is essential for a cure. Line of section should take an inch to two inches of healthy bowel with the growth if possible, and as wide a section of mesocæcum and mesentery as can be done without damage to the bowel circulation. Owing to the ulcerative process on the mucous surface of the growth, the lymphatic nodes are enlarged early in the disease from septic absorption rather than from metastasis of cancer, judging by my experience in two cases. Enlarged lymphatic nodes should be sought out and removed.

In the future I will choose for the operation in resecting the cæcum for removable carcinoma, inversion of both ends of the cut intestine followed by lateral anastomosis by the clamp method between the stumps, or between the stump of the ileum and the most accessible portion of the colon, preferably the ascending or transverse colon.

A review of the literature on this subject since the paper of Cumston and Vanderveer in January, 1902, in ANNALS OF SURGERY, was made for me by Albert Allemann, M.D., of the Medical Library of the Army Medical Museum, Washington, D.C. He adds 38 cases to the number which they report. I append to this paper a brief history of each case and the journal in which the report was made.

## REPORTED CASES SINCE JANUARY, 1902.

SURMONT: Bull. Soc. centr. de med., Lille, 1902, 221. CASE I.—Male, 50 years of age. No previous history. Incision was made, but nothing done. Patient died six days afterward.

ANSCHUTZ, W.: Verhandl. d. deutsch. Gesellsch. f. Chir., Berlin, 1902, xxxi, pt. 2, 413. CASE II.—Male, 40 years of age. A few months before the first symptoms. Operation; death shortly after operation (sutures tear through). CASE III.—Male, 58 years of age. First symptoms a few months before. Operation: resection of cæcum. Death, twelve days after. CASE IV.—Male, 53 years of age. Two months before first symptom. Operation: removal of cæcum. Complete recovery. CASE V.—Male, 30 years of age. First symptom about a year before. Operation: removal of cæcum. Complete recovery.

LAMAS, A.: Revista médica de Uruguay, Montevideo, 1903, vi, 201. CASE VI.—Male, 30 years of age. Four months ago first symptom. Operation: nothing done, drainage; second opening: declared inoperable.

ATHERTON: Maritime Med. News, Halifax, 1903, xv, 174. CASE VII.—Male, 30 years of age. About year before began to have constipation. Operation: incision; more than a foot of bowel removed. Recovery.

BÉRARD: Lyon médical, 1903, c, 431. CASE VIII.—Woman, 30 years of age. First symptom five months previous. Operation: entero-anastomosis, on account of great weakness. Second operation: cæcum removed. Recovery.

BALLOCH, A.: Washington Med. Ann., 1903, ii, 12. CASE IX.—Male, 36 years of age. Cold. Three weeks before first, griping pains. Operation: cæcum removed with 3 inches of ileum. Good recovery.

REVERDIN, J. L. Rev. méd. de la Suisse romande, Genève, 1903, xxiii, 440. CASE X.—Male, 63 years of age. No previous history given. Removal of cæcum. Death on eleventh day.

CESTAN: Toulouse méd., 1903, 2 S., v, 272. CASE XI.—Woman, 52 years of age. Previous dyspepsia symptoms. Operation: "partial extirpation," cæcocolic entero-anastomosis. Recovery; "complete cure" was not intended.

DARLING, C. G., AND LOREE: Med. Record, N. Y., 1903, lxiii, 938. CASE XII.—Male, 46 years of age. First noticed swelling and pain eight weeks before. Operation: cæcum removed. Complete recovery.

NO AUTHOR.—St. Thomas's Hosp. Rep., 1903, Lond., 1904, xxxii, 190. CASE XIII.—Female, 58 years of age. Pain commenced three weeks ago. Operation: resection of 5 inches of ileum, cæcum and part of ascending colon. Patient never rallied; died on third day. St. Thomas's Hosp. Rep., 1903, Lond., 1904, xxxii, 190. CASE XIV.—Female, 65 years of age. Five months previous diarrhœa and pain. Operation: resection of cæcum and small part of ileum; artificial anus. Death on twentieth day.

FROHWEIN, F.: Ein Fall von primärem Cæcum-carcinom. Kiel dissertation, 8°, Kiel, 1903. CASE XV.—Male, 59 years of age. For a month past diarrhœa, etc. Diagnosis: inoperable carcinoma of cæcum. Operation for anus præternaturalis. Six days after patient died.

FRANÇOIS-DAINVILLE: Bull. soc. anat. de Par., 1904, lxix, 166. CASE XVI.—Male, 32 years of age. Three weeks before pain. Operation: ileocæcal resection. Recovery.

SLAUGHTER, R. M.: Virginia Med. Semimonth., Richmond, 1904–5, ix, 401. CASE XVII.—Male, 46 years of age. Suffered from acute appendicitis. Operation: resection of cæcum; recovery.

NEHRKORN AND KAPOSE: Beitr. z. klin. Chir., Tübing., 1904, xliii, suppl., 126. CASE XVIII.—Woman, 64 years of age. Six weeks previous symptom. Operation: patient is weak, therefore anastomosis between ileum and colon. Recovery. Radical operation was not advisable.

HUPPERT, P.: Ueber einen Fall von primarem Gallertcarcinom des Cæcums. München dissertation, 8°, München, 1904. CASE XIX.—Woman, 70 years of age. For thirteen weeks previous had to lie in bed on account of abdominal pains. Diagnosis: tumor of cæcum or omentum. No operation; death. Illinois Med. Journ., Springfield, 1905, viii, 3. CASE XX.—Female, 25 years of age. Pains about one and one-half years before. Operation: cæcum with part of ascending colon removed. Recovered completely.

PLUMMER: Illinois Med. Journ., Springfield, 1905, viii, 464. CASE XXI.—Female, 25 years of age. Pain four years, first symptom. Operation: removal of cæcum and part of ascending colon. Recovery complete.

CARLESS: Med. Press and Circular, Lond., 1905, lxxix, 648. CASE XXII.—Woman, 65 years of age. Symptoms noticed only a few weeks before. Operation: ileocolostomy. Patient's condition did not permit a radical operation. Good recovery.

WILSON, C.: Mobile Med. and Surg. Journ., 1905, vii, 230. CASE XXIII.—Male, 49 years of age. First symptom a few months ago. Operation: cæcum removed Recovery complete.

DEPAGE: Journ. de chir. et Ann. soc. belge de chir., Bruxelles, 1905, v, 194. CASE XXIV.—Female, 66 years of age. Year ago intestinal

obstruction. Operation: anastomosis between ileum and colon; patient was weak. About a month later another operation, but tumor was found inoperable.

GIAUNI, V., AND ROLANDO, S.: Gazzetta degli ospitale, Milano, 1906, xxvii, 1523. CASE XXV.—Male, 61 years of age. About a year previous had pain. Operation: cæcum with 5 inches of ileum removed. Died five hours after.

DEL CASTILLO: Revista ibero-american de ciencias med., Madrid, 1906, xvi, 169. CASE XXVI.—Male, no age given. No previous history. Was not diagnosed until too late; was not operated. Death.

GAYET: Lyon méd., 1906, cvii, 840. CASE XXVII.—Female, 54 years of age. Three months ago first symptom. Operation: a cæcostomy. Twenty days later cæcum removed with tumor. Recovery.

ABERG: Hygiea, Stockholm, 1906, vi, 256. CASE XXVIII.—Female, 56 years of age. About two years ago first symptom. Operation: resection of cæcum and part of colon. Recovery.

SHEARS: Clinic, Chicago, 1906, xxxvii, 719 (Homœopathic). CASE XXIX.—Female, 52 years of age. Two years ago first pain in abdomen. Operation: excision of cæcum and anterior part of ileum. Recovery.

JONES, O. M.: Montreal Med. Jour., 1907, xxxvi, 449. CASE XXX.—Woman, 52 years of age. Complained of pain twelve months previous to operation. Operation: excision of cæcum; Murphy button. Recovered; did well for a year, but died twenty-one months after operation of "cancer of the blood." Postmortem examination showed no return in intestine. CASE XXXI.—Male, 42 years of age. Attacks of vomiting for a year previous. A surgeon removed appendix, and fistula formed. About two years later patient consulted author. Operation: cæcum with portion of colon removed. Recovered completely. CASE XXXII.—Male, 27 years of age. Pains commenced eight months ago. Removal of cæcum with mass of involved omentum. Recovered completely. CASE XXXIII.—Male, 61 years of age. Pains for six months previous. Operation: removal of cæcum and portion of liver (cautery). Died one month after operation. CASE XXXIV.—Male, 42 years of age. Pain sixteen months previous. Operation: resection of cæcum with lateral implantation of ileum. Recovered completely.

BAUBY AND PUJOL: Toulouse méd., 1907, ix, 219. CASE XXXV.—Male, 65 years of age. About six months ago first symptoms. Resection of cæcum. Recovery.

ATHERTON, A. B.: Canada Lancet, Toronto, 1908, xlii, 104. CASE XXXVI.—Male, 30 years of age. For a year previous crampy pains, etc. Operation: about 18 inches of bowel removed. Recovered completely.

LEREBOULLET AND DIXIER: Bull. et mem. soc. méd. d. hôp. d Par., 1908, 3 S., xxv, 397. CASE XXXVII.—Male, 56 years of age. Thirteen months ago he began to lose flesh, and had pain in right abdomen. Not diagnosed. No operation. Patient died. Autopsy: cancer of cæcum.

GIRARD: Rev. méd. de la Suisse romande, Genève, 1908, xxviii, 257. CASE XXXVIII.—Male, 45 years of age. For a year past violent pains in abdomen. Diagnosis: possible tuberculosis or cancer of cæcum. Operation: cæcum excised; Murphy button; complete recovery.

# RESECTION OF THE COLON FOR CANCER AND TUBERCULOSIS.*

BY JOHN H. GIBBON, M.D.,

OF PHILADELPHIA,

Professor of Surgery in Jefferson Medical College; Surgeon to the Pennsylvania Hospital.

THE following ten cases which have occurred in the last six years constitute my entire experience in resection and anastomosis of the colon for cancer and tuberculosis. I have excluded those cases of cancer of the upper rectum in which the sigmoid has been anastomosed with the lower rectum, as this operation is one of entirely different technic from that required for growths above the rectum. I have also excluded several resections of the small intestine up to the ileocolic juncture with lateral anastomosis between the ileum and the colon. I have eliminated a few cases where I have anastomosed the small intestine with the sigmoid for the purpose of side-tracking the colon. In other words, the discussion will be limited entirely to pure resections and anastomoses of the colon. Of these ten cases eight suffered from carcinoma and two from tuberculosis:

CASE I.—H. D.; male; 55 years of age; Pennsylvania Hospital. Diagnosis: *Acute intestinal obstruction; carcinoma of colon; thoracic aneurism and chronic endocarditis. Resection of descending colon and immediate anastomosis,* July 24, 1903. *Sudden death eight hours later.*

This man presented the appearance of having been a hard drinker. His abdomen was markedly distended, with no particular rigidity, pain or tenderness. He was nauseated but had not vomited. Bowels had not moved for five days, in spite of laxatives and enemata. The transverse colon was very much distended and could be easily made out. The abdomen was opened in the median line by an incision extending above and below the

*The Annual Oration before the Philadelphia Academy of Surgery, delivered May 3, 1909.

umbilicus. When the peritoneum was opened a dark-colored fluid escaped. The colon was first examined. It was found normal throughout, excepting just above the sigmoid flexure, where a hard mass could easily be felt. When this was delivered it was found to be a carcinoma, producing absolute obstruction. The abdominal cavity was filled with a quantity of dark fluid containing flakes of lymph. The carcinomatous mass, together with a proper amount of bowel, was resected; two glands were removed from the mesocolon and an end-to-end anastomosis, by means of two rows of silk sutures, was performed. A rectal tube was introduced well above the point of anastomosis; two strips of gauze were placed about the seat of anastomosis and the bowel returned to the abdomen. The cavity was then thoroughly irrigated and closed. A large quantity of gas and liquid fæces escaped through the tube. The operation occupied more time than it should have done, because of the difficulty in bringing the diseased bowel out through the median incision. In another such case I would feel inclined to make a second incision in the left iliac region. The patient did well after operation for about eight hours, when he was suddenly taken ill with cardiac symptoms and died. At the autopsy a large aneurism of the thoracic aorta was discovered, and Dr. Longcope, pathologist of the Pennsylvania Hospital, thinks that the cardiac condition present was sufficient to account for the sudden death. There were evidences, however, as there were at the time of the operation, of peritonitis.

Comments: In this case I should have made a second incision, done a colostomy and postponed the resection until later, or performed a resection and drained the bowel and made the anastomosis later. A lateral anastomosis would have been better than the end-to-end one which I did. Under the circumstances the overlooking of the thoracic aneurism would seem justifiable.

Pathology: Adenocarcinoma of colon; serofibrinous peritonitis; congestion of lungs; general arterial sclerosis; diffuse aneurism of arch of aorta; chronic aortic and mitral endocarditis; left-sided cardiac hypertrophy and slight diffuse nephritis.

Case II.—M. D.; female; 70 years of age; Pennsylvania Hospital. Diagnosis: *Acute intestinal obstruction; adenocarcinoma of colon. Resection and immediate anastomosis,* January 7, 1905. *Death twenty-third day after operation.*

I saw the patient first about nine o'clock on the day of operation, with Drs. Bennett and Musser; there was nothing in the previous history to throw any light on the cause of the obstruction. She had suffered from moderate constipation and had had some attacks of abdominal pain. She had always been very secretive about herself and it was difficult to get any satisfactory history. One noticeable point was that she had habitually restricted her diet to very simple things. She had not lost weight. For four days previous she had been unable to have a bowel movement and had become gradually more and more distended. The distention was more marked on the right side of the abdomen, but at no time was Dr. Bennett able to feel any mass. There had been no nausea or vomiting excepting once, when oil had been given. The temperature was normal; pulse about 80; the abdomen greatly distended, slightly more so on the right side than on the left. The patient complained of some pain on the left side which came on in paroxysms. Nothing could be felt by the rectum or by the vagina. Her general condition was very good, but it was evident that she was suffering from complete obstruction of the bowels, which in a short time would end fatally unless some radical relief was offered promptly. I thought that she was suffering from a volvulus or else from a growth in the cæcal region. A notable point in view of the findings at the operation is the fact that there was no history of ribbon stools or the passage of bloody mucus. Considerable time was lost in convincing the patient of the necessity for an operation, and especially of the necessity for her removal to a hospital. This was finally accomplished, and at about three o'clock I operated. As the right side of the abdomen was more distended than the left, I determined to open through the right rectus. The moment the peritoneum was divided there escaped a quantity of peculiar gelatinous material, light in color, resembling the contents of a colloid cyst. There also presented in the wound an enormously distended cæcum, dark in color, which looked like a cyst. I supposed that there had been a rupture of a malignant ovarian cyst. When the wound was enlarged, however, the cæcum was delivered. It was distended more than I had ever seen it. The appendix was also very much thickened but not distended, and attached to it was a quantity of the same gelatinous material which had escaped from the abdomen. The cæcum

was so distended that I realized that I would be able to do nothing inside the abdomen until its size was reduced. When delivered, a quantity of its contents rushed into the small intestine, rapidly distending this portion of the bowel which had before been practically empty. I thought that in some way the opening from the ileum into the cæcum had been obstructed. The cæcum was punctured with a knife; a large quantity of gas rapidly escaped and the bowel collapsed. The opening was then closed and I made an exploration of the abdominal cavity. There was no mass in the pelvis, the uterus being very small and the ovaries atrophied. I noticed one or two small nodules over the broad ligament, however. Examining the colon I found a mass about the middle of the descending colon. This could not be delivered through the wound on the right side and I therefore opened the abdomen through the left semilunaris. Before I did this, however, I was obliged to reopen the cæcum because it could not be returned to the abdomen, as it had again become distended with gas. Through the opening on the left side I delivered the mass in the colon which seemed to be a carcinomatous growth producing an annular contraction of the bowel. With some difficulty, because of the shortness of the mesocolon, I succeeded in resecting about ten or twelve inches of this bowel, going about 8 inches above the growth and about 3 inches below it. An end-to-end anastomosis was made by means of a large Murphy button. A gauze drain was introduced down to the site of anastomosis and the wound closed. Before closing the wound on the right side I removed the appendix; and it presented the appearance already described which I had never seen before. The patient was on the operating table one hour and forty minutes. Her pulse at the end of the operation was 100 and her condition remarkably good. I was prepared for considerable shock but was surprised later to find the patient in excellent condition and remarkably free from pain.

January 9, 1905: Since the operation the patient's progress has been surprisingly satisfactory. Last night her temperature rose to about 102, but this morning it is 99 and her pulse about 110. She has been taking a moderate amount of liquid nourishment and salt solution enemata. Yesterday and last night she passed a large amount of flatus and is much more comfortable. The distention of the abdomen is greater this morning than it

has been since the operation, but there is less pain and the patient is much more comfortable. She has received small doses of calomel to relieve her distention, and this morning in addition to this she was given strychnia.

January 10: Last evening the distention had increased considerably, the patient was very uncomfortable from it,—had some difficulty in breathing and was belching a good deal. I therefore decided to open the wound on the right side and tap the cæcum. This I did without any difficulty at all, administering the patient a small amount of ethyl chloride. The colon was exposed for an area of one and one-half inches, and a small trocar introduced. A quantity of gas escaped through the cannula, which was left in position, and the patient was rendered more comfortable at once. Since doing this, there has been a marked improvement in her condition; she has had two bowel movements and her temperature and pulse are both lower. It looks now as if she would certainly recover.

January 16: Continues to improve, temperature remains about normal. On the sixth day after the operation there was a marked odor to the dressing on the left side, and when I removed the gauze packing there was an escape of gas and some liquid fæces. For twenty-four hours previous to this the patient had been unable to void the urine, and had to be catheterized. Since the change of dressing she has voided her urine. The discharge from the left wound has been quite free, and contains some fecal matter. There has been less fecal matter passed per rectum, and also less flatus. The right wound looks well; it is packed with iodoform gauze down to the exposed bowel, from which there is no leakage. To-day the patient is taking semi-solid food and looks much better. The button has not passed.

January 30: Two days ago, when dressing the left wound, I extracted two large pieces of mucus which looked like sponges. These were evidently sloughs from the colon somewhere and I suspect from the cæcum. After their passage there was some leakage from the small puncture of the cæcum of the right wound. Yesterday I introduced a glass catheter into this opening and passed quantities of salt solution through the colon, washing out a quantity of fæces but no more sloughs. I then injected some salt solution and whiskey which was followed later by malted milk. This was done because the patient declined to take suffi-

cient food. She gradually grew much weaker and has been comatose at times. To-day she grew still weaker, and died about 2 P.M.

A post-mortem examination was made by Dr. Longcope, who found that the colon had sloughed at the point of anastomosis and that the button had dropped into a pocket behind the colon.

Comments: A primary resection should not have been done in this case nor should a Murphy button have been used. A lateral anastomosis would have been better than an end-to-end one.

CASE III.—G. D.; female; 68 years of age; Pennsylvania Hospital. Diagnosis: *Partial obstruction and carcinoma of transverse colon and sigmoid. Resection of transverse and descending colon; immediate anastomosis,* March 5, 1905. *Recovery;* well to-day.

I saw this patient in consultation with Dr. David Edsall. The history of active trouble in this case extends over but three weeks. Previous to that time, however, the patient had had considerable trouble with her digestion and, at times, difficulty in having her bowels move. She had also had attacks of acute pain, evidently peristaltic in character. Three weeks ago she was suddenly seized with severe abdominal pain, and her bowels were opened with some difficulty. There was little distention at any time, but there was a great deal of abdominal pain and marked peristalsis. The peristalsis was visible through the abdominal wall. Examination a few days later revealed a mass in the left iliac fossa which was movable and tender; it varied much in size, and sometimes a little kneading would cause it almost entirely to disappear. There was never at any time a discharge of blood or mucus. When, with Dr. Edsall, I saw her we discussed but two possibilities: one, malignant disease of the sigmoid, and the other a chronic intussusception. My inclination was toward the first of these, as the mass seemed hard and there had been no discharge of blood or mucus as would have occurred with an intussusception. The patient was removed to the Pennsylvania Hospital.

I opened the abdomen through the outer border of the left rectus, opposite the spine of the ilium. As soon as the peritoneum was divided there presented in the wound what I supposed to be a dilated colon, but which proved to be the stomach. After

some difficulty I was able to differentiate the various structures and discovered we were dealing with a large malignant mass about the middle of the transverse colon which had gravitated to the left iliac fossa, dragging the stomach with it. Here the mass had become adherent to the sigmoid, the wall of which was involved in the cancer mass, but the sigmoid was not obstructed. The distal portions of the transverse and the descending colon were perfectly flat—contracted, in fact, to about the size of the small intestine. Proximally to the growth there was not much distention. My first idea was to do a double resection, first of the transverse colon and then of the sigmoid. The entire mass was surrounded by omentum. I tied off the omentum close to the greater curvature of the stomach and included in the ligatures the mesocolon, in order to shut off the lesser peritoneal cavity. When I had done this I found that if I resected a proper amount of bowel at the two situations there would be left only about five or six inches of descending colon, and rather than leave this and make two anastomoses I concluded to remove the entire transverse and descending colon with the involved portion of the sigmoid and attach the hepatic flexure of the colon to the distal portion of the sigmoid by the end-to-end method. This I did without any difficulty after the method of Moynihan, using the Doyen forceps. The anastomosis was the most satisfactory one I have ever made; there did not seem to be the slightest possibility of any leakage. Therefore I did not insert a drain, but closed the abdomen in layers. The operation took one and one-quarter hours. The patient was anæsthetized with ethyl chloride and ether. The glands in the mesocolon and mesosigmoid were not much larger than normal. The patient reacted well from the operation. At the beginning of the operation her pulse was 120; at the conclusion it was 90.

March 6, 1905: Her temperature since the operation has not reached 100 and her pulse at one time was 108. This morning it was 88. She has passed urine frequently but without difficulty and also expelled some flatus through the nozzle of a syringe. She has been very troublesome and nervous, but so far as her general condition is concerned she is in excellent shape and, I think, should make a good recovery.

March 13: Since operation the patient has done remarkably well; the bowels have moved freely and, excepting a marked

melancholic tendency, there has been nothing to worry about. For the last day or two she has complained of frequent micturition. To-day I dressed the wound and found the skin lifted up by an accumulation of very odoriferous pus. Quite a little gas escaped when the wound was opened. The skin had healed perfectly; all the stitches were removed. This infection had taken place without disturbing her general condition and without giving her any amount of pain. I believe that the infection is only a superficial one and do not think it is connected in any way with the seat of anastomosis.

March 22: Since the last note there has been more or less fecal discharge every day through the wound; at times it has been quite profuse. Lately there has been a slight rise in temperature at night, but otherwise the general condition seems to be good. Inability to control the urine at times is very distressing to the patient. For three days she has been sitting up in a wheel chair for an hour or more.

March 29: There has been no fecal discharge from the wound for three or four days and her condition is greatly improved, the bowels moving regularly without aid. She is eating much better. She spends four or five hours out of bed every day.

April 2: The wound is healing rapidly, but she developed last night a phlebitis of the left leg.

April 3: The pain in the leg is less but the swelling remains about the same, and there is a slight increase in the pulse rate with no fever.

May 10: She has been doing very well until about two weeks ago, when the sinus was so nearly healed that I thought that I might leave out the gauze packing, which I did for two days. When I came to dress it at the end of this time an accumulation of pus had taken place and some burrowing under the skin externally. Since then there has been more pus and a small amount of fecal matter discharged. To-day I determined in view of the fact that there had been a slight rise in temperature in the evening, that there must be some fault in the drainage, and gave her ethyl chloride, opened up the wound thoroughly, curetted out two pockets and packed it with gauze.

May 22: Wound has been rapidly contracting and her general health has been much better. She is able to go about and is going home to-morrow.

May 1, 1909: Patient's wound has remained healed and she is well to-day; no evidence of recurrence.

Comments: Probably a lateral anastomosis here would have given a better result, or perhaps a drain might have shortened the convalescent period.

Pathological diagnosis: Polypoid adenocarcinoma and tuberculosis of colon.

CASE IV.—J. S.; male; 40 years of age; Pennsylvania Hospital. *Tuberculous strictures of ileum; tuberculous peritonitis. Resection of ileum and cæcum,* September 28, 1905. *Second operation,* January 20, 1906, *for fecal fistula. Lateral anastomosis of ileum and transverse colon. Third operation,* January 11, 1907, *same condition; lateral anastomosis of ileum and sigmoid. Fourth operation,* May 1, 1907; *resection of transverse colon with a portion of the ileum. Fifth operation,* May 19, 1907; *jejunostomy. Died* May 21, 1907, *twenty months after his first operation.*

This patient, a negro, had been in the hospital ten days or two weeks. His symptoms were so obscure that it was impossible to make a diagnosis. He complained of general pain in the lower half of the abdomen, with considerable disturbance of digestion. He said he had vomited, but he vomited only once or twice after his admission. A test meal was given but nothing abnormal was found in the examination. His abdomen was always scaphoid and somewhat rigid. On the right side in the iliac region, on two occasions I thought I felt a distinct movable mass which was probably an enlarged gland. There was no fever at any time and no blood or mucus in the bowel movements. A rectal examination showed some tenderness behind the bladder. After keeping him under observation for a number of days I concluded that he had probably a tuberculous peritonitis, and that an operation was justifiable. When the abdomen was opened through the right rectus the first thing which the hand encountered was the ileum very much contracted at two points, one near the cæcum and the other a number of inches away from it. These areas of contraction were probably one and one-half to two inches in length and the whole thickness of the bowel was involved, the peritoneal coat being studded with small tubercles. The mesocolic glands were enormous; the mesenteric glands on either side of the diseased ones seemed perfectly normal. There

was not an excessive amount of fluid in the peritoneal cavity. There was no evidence of tuberculosis elsewhere. I determined to excise the entire diseased area together with the cæcum and the enlarged glands. In order to get out all the glands and the mesentery which contained them, I found it necessary to divide the ileum at least 12 to 18 inches away from the proximal side of disease. The colon was divided at the middle of its ascending portion and its end inverted by two rows of sutures—one of catgut and one of celluloid thread. The same was done with the end of the ileum, and then a lateral anastomosis of the ileum and transverse colon was made with the Doyen forceps. The operation was perfectly clean and there was no possible soiling. It occupied a very long time, two hours and ten minutes. This was partly due to the fact that after making one division of the ileum and inverting the ends, I found it necessary to go higher up on the bowel because of the enlarged glands in the mesentery. On examining the specimen after removal it was found that the distended portion between the two strictures contained several ounces of watermelon seeds. He said that he had not eaten watermelons for nearly a year, but considering the season and the tendencies of his race this is to be doubted.

September 30, 1905: He has done very well since the operation and shows no bad symptoms at all.

October 2: He had considerable pain in the abdomen last night and vomited. To-day his abdomen is rigid and there is some soiling of the gauze drain which was introduced. Ethyl chloride was administered and the drain withdrawn. There escaped a quantity of gas and considerable liquid fecal matter. This leak, I think, comes from the inverted ends of the bowel as the gauze drain extended down to this point and not to the point of anastomosis. Notwithstanding this leak he is now comfortable and the bowels have moved. A fresh gauze drain was introduced. The patient was discharged December 19 with a small sinus.

January 20, 1906: The patient has improved a great deal since his first operation but has continued to suffer from a slight fecal fistula. The discharge from this fistula is almost liquid, but at times—the patient says—fecal matter comes out. He complains also of painful peristalsis, and I had an opportunity

to observe this in a distended coil of bowel extending from the left iliac fossa up in the direction of the wound. Thinking that possibly the fistula led to the blind pouch of colon left at the previous operation, I determined to make the incision on the outer side of the old scar, and this I did. Before being able to make out the situation, however, I was obliged to separate the fistulous opening in the wall from the bowel and do considerable separation of adhesions. Finally I discovered that the fistula opened into the bowel probably at the point of anastomosis. The proximal portion of the ileum was enormously distended and hypertrophied. This extended up for about two or three feet. The colon was quite collapsed. As the intestines were so matted together in the right upper quadrant I determined to make a new anastomosis between the ileum and the transverse colon, and this I did after the manner of Moynihan. The fistulous opening into the bowel I closed with two catgut sutures and introduced a drain down to this point. The new anastomosis was surrounded by omentum and the abdomen closed, excepting at the point of drainage.

January 22: Patient is more comfortable to-day and has done remarkably well since his operation.

March 1: Patient was discharged from the hospital to-day, the sinus still persisting but no fecal discharge.

January 11, 1907: Since his last operation he has been free of pain and has gained considerably in weight. The fecal fistula redeveloped, however, and has continued open ever since. In March, Dr. Le Conte operated and tried to close the fistula, but unsuccessfully. There is no longer any painful or visible peristalsis, but large quantities of fecal matter escape through the fistula. I determined that the best thing to do was to open the abdomen on the left side, divide the ileum near the old point of anastomosis and attach the proximal end by lateral anastomosis to the sigmoid. I opened the abdomen through the sheath of the left rectus and found the abdominal cavity in good condition excepting for numerous small tubercles over the bowel and mesentery. There was no fluid and no enlarged glands. The last anastomosis was in good condition and working. There was no hypertrophy or distention of the bowel. At the second operation I did not divide the ileum but simply made a lateral anastomosis. To-day I cut the ileum near the old anastomosis,

inverted the two ends and attached the proximal portion to the upper portion of the sigmoid by a lateral anastomosis. The steps of the operation were easily performed and the result apparently was very satisfactory. The abdomen was closed without drainage. I did not do anything to the fistulæ on the right, hoping that they would close.

February 4: Since this operation the patient has progressed very satisfactorily. At first there was free discharge of fecal matter from the old fistula, but this stopped after a few days. The fistula was Y-shaped, having two external openings, one of which closed very promptly after operation, but the other is still discharging a small amount of mucus and pus. The patient's temperature is normal and he is able to move about and is quite comfortable.

The specimen removed at the original operation was exhibited at the meeting of the Philadelphia Academy of Surgery held on February 4, 1907. "It is 38 cm. long, 34 cm. of ileum and 4 cm. of cæcum. The mesentery is attached to the intestine and contains a number of enlarged glands. There are two constrictions, one 5 cm. from the ileocæcal juncture, and the other 13 cm. above this one. The bowel between the two constrictions is very much distended and thickened; in this distended portion between the two constrictions there were found, when the specimen was examined, two or three ounces of watermelon seeds with one grape seed. The peritoneal covering of the bowel and mesentery was studded with small tubercles, and numerous hard bodies can be felt in the intestinal wall. The mesentery is very thick and contains a number of large glands, the largest measuring 4 x 3½ x 2 cm. These glands on section proved to be caseous. The appendix is tightly bound down to the cæcum by adhesions. The lower stricture is 3 cm. in length and the lumen of the bowel at this point ½ cm. The second stricture is 1 cm. in length and the lumen 1½ cm." The pathological diagnosis was tuberculosis of the intestine with chronic ulceration; tuberculosis of the mesenteric glands, and hypertrophy of the muscular wall of the intestine.

May 1, 1907: Since the last operation the patient's general health has been very good, but there has continued to discharge from the sinus a quantity of pus and mucus. He says fecal material at times also passed out, but I have had his dressings

carefully watched for several consecutive days at the hospital, bringing him in for this purpose, but have found no fecal matter. He is very much disturbed by the discharge and the necessity of constant change of dressings, so I determined to open the abdomen again and remove all of the bowel that had been side-tracked by the last operation. To-day I opened the abdomen through the right rectus and excised the colon from the splenic flexure back to the point of original excision. Together with this bowel there were removed two feet of ileum. At the point of division of the colon the bowel was perfectly healthy, and I had no difficulty in turning it in. The whole intestine was one mass of adhesions and I had considerable difficulty in isolating the portion which I wished to remove. A thorough twisting and malposition of the small intestine made the operation long and difficult. The only portion of the bowel removed which was really distended was the ascending colon, and that was filled with tuberculous ulcers of the mucous membrane. The peritoneum generally was in much better condition than at the previous operation, and at several points on the small intestine there were cicatrices of healed tuberculous lesions. When I removed the bowel I felt that I had taken out all the diseased tissue except a few mesenteric glands, and hoped that the patient would be entirely relieved. The abdomen was closed without drainage excepting for a small piece of gauze extending just through the abdominal wall at the seat of the old fistula. The operation lasted about two hours.

May 3: Patient's temperature has remained normal since operation; he has had no vomiting, no distention, and his general condition has been very good.

May 21: The patient did very well for several days after his last operation. Then he began to have fecal discharge that I judged came from the loop of small intestine that had been adherent to the old abscess and which I had tried to cover with peritoneum. Discharge has increased during the last few days and the patient has emaciated a great deal. I tried rectal feeding, but this did not help matters. To-day I decided to do a jejunostomy or resection of the perforated bowel. The patient was in very poor shape. He was put on the operating table and four pints of normal salt solution put into his circulation. Under morphia, ethyl chloride and ether anæsthesia the wound was

opened up, the loop of bowel delivered, and the perforation found. It was too large to close, and after thoroughly cleansing the cavity the bowel was fastened in the wound with gauze packing and a tube passed down into the distal portion of the loop and fixed with a purse-string suture. The patient was immediately given a pint of salt solution and two ounces of whiskey through the tube.

May 20: Patient is in pretty bad shape, although he was much better last night than before his operation. He has been given raw eggs and peptonized milk through the tube every three hours and has vomited small amounts at times to-day. His temperature is subnormal and he seems in pretty bad condition.

May 21: Patient died to-day. At the postmortem his entire intestinal tract measured but 19 feet.

CASE V.—S. B.; female; 57 years of age; Pennsylvania Hospital. Diagnosis: *Obstruction of bowels due to carcinoma of sigmoid. Operation: Colostomy, and eight days later resection and anastomosis. Recovery, with death from recurrence one year later.*

This patient was a rather thin person who gave a history of ribbon stools for some time with marked constipation. She stated that she had never passed blood excepting after the use of an enema and then only a slight amount. Had never had any previous attack of obstruction. She was a Christian Scientist, and her treatment was confined to this art until about a week ago when constipation became much more marked; she then took castor oil. For forty-eight hours she passed neither fecal matter nor gas, her abdomen becoming more and more distended, and she has vomited everything that has gone into her stomach. When I saw her at about 10 P.M., her condition was good,—the abdomen was markedly distended, coils of bowel and peristalsis being plainly visible through the abdominal wall. Dr. Lee had examined the rectum and could feel nothing abnormal. The sigmoid could be felt, and was markedly distended. Most of the pain and tenderness was located about the cæcum. I urged immediate operation, with the intention of establishing an artificial anus and later removing the cause of obstruction if it were removable. The abdomen was opened through the left rectus and a growth about the middle of the sigmoid readily found. There were a number of enlarged glands in the mesosigmoid.

The growth was of the contracting variety and had completely shut off the bowel. I had no difficulty in delivering the intestine, and then made an anastomosis between the bowel above and below the growth by means of a Murphy button. I left this knuckle of bowel completely outside the wound. In a few days, the patient being in better condition, I intended to resect all the involved intestine. I was greatly tempted to do this at the time of operation because the patient seemed in good condition, but because of past experience and the experience of others deemed it unwise.

September 10: Although patient has passed some flatus there has been no bowel movement. Some distention still exists and patient is very uncomfortable. To-day I opened the distal portion of the bowel; a prompt escape of a large amount of gas and fecal matter followed.

September 16: Two days ago, eight days after first operation, I resected the involved sigmoid. Patient had improved a great deal and seemed in good condition. I found that the wound had become infected from fecal discharge and had therefore to exercise great care to prevent infection of the peritoneum. The area was well walled off and I was able to draw the bowel out very satisfactorily. I made a wide resection of the involved portion, invaginated the two ends and did a lateral anastomosis, using linen thread. The operation was easily accomplished and satisfactory in every way. A small drain was put through the peritoneum in the middle of the wound and another down to the peritoneum at the upper angle where the infection had occurred. The patient stood the operation well and is now in good condition; her only complaint is of gas. She made a very satisfactory convalescence and was discharged October 12, 1907.

January 21, 1908: Patient came in to-day; seems perfectly well; weighs 104 pounds. Thinks she weighed 80 when she went to the hospital; weighed 79 pounds when she left. Bowels move regularly without a laxative.

June 2: Patient complains of considerable lassitude and says she has some abdominal pain. Bowels are moving, however, and I can feel no evidence of any recurrence. She thinks she has lost weight, but her weight is exactly what it was on her last visit.

July 22: Patient has been seen by a physician who told her

she had a recurrence of her trouble and that all he could do for her was to make her comfortable. This has depressed her very much and tended rather to aggravate her symptoms. She says that she sleeps badly, her appetite is poor, and that she has almost constant pain in the left iliac fossa. The bowels, however, move regularly from cascara, and there has been no blood or mucus in the movements. Weight, 92½ pounds. On examination there is some hardness to be felt to the left of the wound, but it feels as if it might be in the abdominal wall. I am by no means sure she has a recurrence but have advised X-ray treatment, for which she will go to Dr. Manges.

Patient, a few weeks after this note was made, died from recurrence, but had no obstruction.

CASE VI.—M. W.; female; 58 years of age; Jefferson Hospital. Diagnosis: *Carcinoma of appendix and cæcum. Resection of cæcum, lateral anastomosis, October* 5, 1907. *Death on seventh day after operation.*

This patient was referred to me by Dr. Robert L. Gibbon, Charlotte, N. C. She had always been healthy, and had given birth to eight children. In February, 1906, she had an attack which was diagnosed as appendicitis. Was ill a week; the symptoms disappeared under rest and ice. Six weeks later she had a second attack which lasted but a few days. A marked symptom in these attacks was severe localized pain and slight temperature. No nausea or vomiting and no urinary symptoms in either of these attacks. She remained well until six weeks ago, when she had another attack similar to the first but more marked. There was considerable fever and, excepting for the nausea, the symptoms were typical of an acute appendicitis. In this last attack a mass could be felt in the cæcal region. She gradually improved and was quite comfortable when I saw her. Examination of the abdomen was negative excepting for a tender and slightly movable mass in the right iliac fossa. In view of the history and the absence of other symptoms it seemed likely that this was a case of appendicitis with a walled-off abscess. I advised operation, and two days later, October 5, I operated at the Jefferson Hospital.

The abdomen was opened through the right rectus and a hard mass encountered behind the cæcum. There were no omental adhesions. General abdominal and pelvic cavities were walled

off and a line of cleavage sought between the mass and the neighboring viscera. The mass was so dense that I feared I was dealing with a malignant growth. Finally I got the cæcum separated. When brought to the surface I found that the appendix had separated at its attachment and that there was quite a large opening in the cæcum. Where the appendix was detached there was evidently a malignant growth, and on examining the interior of the cæcum I found that this growth extended across the lower end of the bowel and up as far as the opening of the ileum. I then proceeded with a resection of the cæcum, going 6 or 8 inches above the growth and making a lateral anastomosis between the ascending colon and the ileum, using linen thread for the purpose. When I had completed the anastomosis I proceeded to get out what remained of the appendix; this was a difficult undertaking, as it was tightly bound down. The distal portion of the appendix, however, did not seem to be so much diseased as the proximal portion. It was impossible to ligate the mesoappendix as I simply had to dig the appendix out of its bed behind the cæcum. A gauze drain was put in and the wound partially closed.

October 8: Patient has done only fairly well since operation. Yesterday morning she seemed in good condition; but in the afternoon she suffered a great deal from nausea but vomited only once or twice, and then only small quantities. She voids urine voluntarily; her temperature range is between 99.2° and 101°. She has taken very little nourishment and drinks water in small quantities. The bowels have not moved though she passed some flatus to-day when an enema was given. There is no distention of the abdomen; the tongue is moist. Nausea and backache are the only complaints which she makes. Pulse has been somewhat rapid, ranging from 110 to 130.

October 9: Patient is better, though still has occasional nausea. She has complained of distention, but this is not perceptible, and has passed large quantities of gas by the bowel. Last night she had a slight movement following an enema. She has taken little in the way of nourishment excepting peptonoids, but she has had nutrient enemata. She passes a good quantity of urine. Her temperature varies from 99.2° to 101°.

October 11: Patient's bowels have moved very satisfactorily and a number of times. There is no vomiting but the nausea

continues, although she is able to take a certain amount of liquid nourishment and stimulation. Her temperature continues around 100° and 101°. Her pulse remains between 110 and 120. There has been a decided falling off in the urine and to-day she has passed little or none.

October 12: Her condition yesterday grew much worse. She was in a stuporous condition all day, secreted very little urine and declined to take nourishment. The bowels moved five or six times. I changed the drain the day before, and although it was soiled and had a bad odor there was no escape of fecal matter or pus on its withdrawal. Her condition continued to grow rapidly worse and she died at 4 o'clock this morning. It is hard to know exactly what caused this death. There is no doubt that the anastomosis was working perfectly satisfactorily. There was no distention and no vomiting, so I felt if there was a peritonitis it must have been a low grade of infection. There was some kidney secretion in the last twelve hours, but I think that the kidneys were largely the cause of the death.

Pathological diagnosis: Cylindric-celled carcinoma arising from an adenoma.

Case VII.—G. N.; male; 33 years of age; Jefferson Hospital. Diagnosis: *Carcinoma of ascending colon,* March 28, 1908. *Recovery; well at the present time.*

This patient gave a history extending over 6 or 8 months. During this time he has had considerable soreness and tenderness in the right upper quadrant of the abdomen, in which a tumor has developed. He has had very black, tarry stools. Has never vomited, and pain is uninfluenced by eating. He has no pain referred to the shoulder or back. There is no apparent distention of the stomach. Examination shows a marked rigidity below the costal border and the sensation is conveyed to the hand as of a tumor beneath the upper half of the right rectus; it is exactly in the position of the gall-bladder. There is no history of colic, and I was inclined to believe that he had a duodenal ulcer with a mass of adhesions about it. Others thought that the tumor was probably a gall-bladder. His hæmoglobin was 65 per cent., but he had a good proportion of red blood cells. His bowel movements were very black, but it is reported that no blood was found. I opened the abdomen through the right rectus and found a large growth in the hepatic flexure of the colon, covered by adherent

omentum. There was no extension to the gall-bladder or liver, but there was an extensive involvement of the colic lymph-nodes. The patient was in no condition to stand an extensive operation; his pulse became quite weak on the table. I determined that it was worth while to attempt an excision of the growth, but thought it wiser to do the operation in two stages. I therefore divided the ileum near the ileocolic juncture, closed both ends and then made a lateral anastomosis (Moynihan's method) between the proximal portion of the ileum and the transverse colon. I put in a small drain down to the closed distal end of the ileum.

April 1: Patient is in good condition. Drain was changed to-day. I think in two or three days I will be able to complete the operation.

April 11: Patient has improved very much since the first operation, and seems in good condition to stand the second. The abdomen was opened through the same incision in which the drainage had been going on, and in which there was a slight infection. I had no difficulty in bringing up the cæcum and ligating its mesentery. I then divided the transverse colon and inverted it. In bringing the mass out of the abdomen, I was surprised to find a coil of small intestine adherent on its inner posterior aspect. On careful examination this proved to be the duodenum. At first it looked as if a resection of this portion of the bowel would also be necessary, but I found when I separated it that practically only its peritoneal coat was involved in the mass. Several sutures were put in to repair the loss of the peritoneum. There was no involvement of the liver or gall-bladder in the growth. The kidney was thoroughly exposed, but there was no extension of the disease to it. A posterior drain was carried out through a puncture in the loin. A small drain was then carried down to the inverted colon and another placed in the superficial wound at its lower extremity. Patient stood his operation well, considering the great extent of it.

April 15: Patient's condition is very satisfactory. Two days ago I was worried because he had considerable cough, which is probably due to the fact that he is a miner and has a miner's lung. His bowels have moved well.

April 24: Patient is making a very satisfactory recovery, although there has been considerable discharge of the wound, which was infected at the time of the second operation. Patient is sitting up and his bowels are moving normally.

May 17: Microscopical diagnosis: cylindric-cell epithelioma. Wound entirely healed. Patient gone home.

February 12, 1909: Letter from Dr. G. A. Cunningham, the patient's physician: "He has gained thirty pounds, has no indigestion, flatulence never occurred; he is now engaged at the laborious task of coal mining, but has had no complaint of any kind regarding weakness of the abdominal wall. He has had no medical assistance whatever since the operation. His bowels are regular."

CASE VIII.—M. A.; female; 71 years of age; Bryn Mawr Hospital. Diagnosis: *Acute intestinal obstruction due to carcinoma of splenic flexure. Colostomy,* May 12, 1908, *followed by resection* May 20, 1908. *Death* June 6, 1908.

This patient has had more or less trouble with her bowels for about a month, and during the last four or five days has had difficulty in having a movement. When I saw her just before operation her abdomen was distended; there was no evidence of fluid and she was vomiting. Her temperature and pulse were normal and she seemed in good condition. I thought it wise to operate at once, and as I believed the obstruction to be in the upper rectum, I made an incision through the outer portion of the lower left rectus. The small intestine was considerably distended and filled the pelvis. The rectum, sigmoid and descending colon were collapsed. The transverse colon was distended. Passing my hand up to the splenic flexure I found a small hard mass in the bowel. Instead of making a lateral anastomosis between the transverse colon and the sigmoid, which I could easily have done, I made another small opening in the upper portion of the rectus, hoping that I might be able to deliver the growth through it; I found, however, that it was situated just at the splenic flexure and that only with great tension could it be brought within the wound. It was about the size of a hulled walnut and was shaped like a Murphy button, and apparently completely obstructed the bowel. I then made an opening in the transverse colon after fixing it in the wound. I used Stewart's method for draining the bowel.

May 20: Patient has made a very good recovery from first operation, and to-day I undertook the removal of the growth. I first closed the colostomy opening, increased the wound, tied off the gastrocolic omentum, divided the colon proximal to the

colostomy wound, and then proceeded to remove about 8 inches of the transverse colon together with the splenic flexure in which a small hard growth was present. I also removed about 4 inches of the descending colon. I had considerable difficulty in separating the growth from the spleen, and in doing so tore off a small portion of the spleen, which caused a rather profuse hemorrhage, which was controlled by a pack. The mesocolon was so short that it was difficult to get the ligatures behind the growth. I finally managed to get the growth out fairly satisfactorily. There was present a small hard nodule in the kidney, but I could not make out that it had any connection with the growth in the colon. The ends of the divided colon were inverted and a lateral anastomosis made. Catgut sutures were used for the deeper suture and linen thread for the outer. The operation was an extremely difficult one and required about an hour and fifty minutes for its performance. I think it would have been easier if I had made a lateral anastomosis and short-circuited the growth at my first operation instead of doing a colostomy. The removal of the splenic flexure would have been just as difficult, however, but the operation would have taken less time. The patient stood the operation fairly well.

May 25: For several days after operation she had a great deal of nausea and vomiting. Gastric lavage relieved the vomiting. During the past two days she has had a bad attack of diarrhœa; during the last 24 hours but 15 stools, but in the previous 24 hours 28 stools. These occurred without the administration of any laxative whatever. Irrigation of the rectum relieved her a great deal and she is much better to-day. There is a good deal of odor about the wound and the drain has not yet been changed. Her temperature range is between normal and 100°. Her pulse, which was quite rapid on the day after operation, reaching about 160, has recently remained in the neighborhood of 100.

May 26: To-day I removed the packing. There was no bleeding; the wound is very foul and there is some sloughing along the muscle edges. She is still very weak but the diarrhœa is much better. The great difficulty is to get her to take sufficient food. She has been gotten up into a chair and put out in the yard, which I hope will help her.

May 28: Fecal fistula has developed—but free stools by rectum.

June 6: Patient died to-day after gradually growing weaker. Temperature has not been above 100° for a week and lately has remained a little below normal. Death probably resulted from a low-grade infection. No post-mortem examination was made. Through an error in technic the sections of this tumor were spoiled and the rest of the growth lost. There can be no doubt of the clinical diagnosis, as it resembled in every way the growths found in Cases I, II, V, and X.

CASE IX.—S. B.; female; 27 years of age; Pennsylvania Hospital. Diagnosis: *Tuberculosis of cæcum and peritoneum. Resection of cæcum. Recovery;* well to-day.

This negro girl was admitted to the ward because of what was supposed to be a pus tube on her right side. She stated that she had had trouble with menstruation and considerable abdominal pain for some time, and that the week or two before she came into the hospital she had a great deal of pain and, she thought, some fever. On admission her temperature was 99½°. There was a distinct mass in the right iliac region; there was great tenderness on vaginal examination, especially on the right side; the mass was very hard for a pus tube and I thought it likely that she had an appendicitis as well as a pus tube. She had no general abdominal pain. I opened the abdomen through the right rectus near the median line and found the omentum adherent over the cæcum. Exploration of the pelvis showed numerous adhesions between the uterus and the intestine and all around the tubes and the ovaries. These were recent and were easily broken up. The rest of the cavity was well walled off with gauze from the mass in the iliac region, and then I discovered that the mass was not the appendix but was composed of a thickened cæcal wall and adherent omentum. Close investigation showed thickening and a mass in the cæcal wall with extensive infiltration, making the cæcum quite friable. The omentum was then tied off. The mass was about the size of a silver dollar and involved the anterior wall of the cæcum. There were numerous enlarged glands in the mesentery of the ileum and cæcum and numerous tubercles over the small intestine. There was quite a ring of thickening around the ileum about a foot from the cæcum, but no constriction. I determined to resect the cæcum. I then discovered another mass higher up in the cæcum, and in order to get beyond the disease was obliged to

remove the colon as far up as the hepatic flexure. The ileum was divided near the cæcum and the ends inverted with catgut and linen thread. A lateral anastomosis was then made between the middle of the transverse colon and the ileum. The transverse colon was also covered with adhesions, the omentum being adherent to it, and it was quite difficult to find a clear spot for the anastomosis. The divided mesentery of the ileum was sutured to the mesocolon to prevent any possibility of a hernia through this opening. Two small gauze drains were passed, one to the site of anastomosis, the other to the inverted colon, and the wound closed. The appendix was imbedded between the cæcum and omentum but apparently was not the original seat of the trouble.

Except for some superficial infection of the wound and two alveolar abscesses the patient made a good recovery. The wound healed by granulation, but there was no leak. Discharged February 24, 1909. The patient's present condition is normal. The pathologist expected to find tubercle bacilli because of the appearance of the specimen, but was unable to do so on repeated examination. The gross picture was typical of tuberculosis.

Case X.—M. H.; female; 57 years of age; Mercer Hospital, Trenton, N. J. Diagnosis: *Carcinoma of sigmoid. Resection and immediate anastomosis,* January 31, 1909. *Death,* February 14, 1909.

I saw this patient in consultation with Dr. Holcombe and Dr. Ridgeway. She has one child who is 20 years of age. The mother has always been very well until seven years ago, when the left breast was removed for what appeared to be cancer. No microscopic examination of the growth was made. For some months she has been troubled with constipation, but has passed neither blood nor mucus. She has also lost some weight in the last few months. It is said that she had a tumor in the right breast; the tumor has disappeared. From the history given of this growth, I think that it was probably a cyst. Three weeks ago she began vomiting and her abdomen became markedly distended; since when she has been able to retain practically no food and has had no satisfactory bowel movement. Numerous enemata have been given and small particles of fecal matter have at times been returned. She was a thin, anæmic woman, looking older than her age, but in fairly good condition. The abdomen

was markedly distended and the vomiting was more or less persistent, but not of a fecal type. Palpation showed some rigidity in the region of the sigmoid, but more in the upper right quadrant. The ascending colon seemed to be distended, and as there was much tenderness over the sigmoid, I concluded the obstruction was probably at this point.

Following a hypodermic of morphia and atropin, she was given ethyl chloride and ether, and the abdomen opened through the left rectus. I found the descending colon very much distended, and on withdrawing the sigmoid came at once upon the cause of the obstruction, which was a growth involving the interior of the bowel and producing so marked a constriction as to practically completely obstruct it. Only one gland could be felt in the mesentery. About 6 inches of bowel was excised, including the growth, and a lateral anastomosis done. The ends of the bowel were inverted with catgut and silk and the anastomosis made with catgut and silk; as the operation was accomplished outside of the abdomen and the wound well protected with gauze, no drainage was inserted. While the abdominal wound was being closed a rectal tube was inserted into the rectum and a quantity of gas and liquid fæces escaped and the abdominal distention at the same time disappeared.

February 8: The patient's wound is healed and there is no pain or abdominal tenderness. The abdomen has been perfectly flat ever since her operation. During the last few days she has been vomiting and has had a very troublesome diarrhœa, I am told. The night before last she vomited practically everything that was taken. I talked with Dr. Holcombe over the 'phone and advised that her stomach be washed out. To-day I got a very good report from her. There has been no vomiting since yesterday morning, the bowels have moved but once, and she has been able to retain liquid food.

February 14: I had supposed that this patient was doing very well until last evening, when I received a telephone message saying she was in a bad condition and that a mass had developed in the left loin. I felt sure that there had been a leak at the site of anastomosis, and advised that the wound be laid open freely, and arranged to see the patient to-day. When I arrived I found her in an extremely low condition. On removing the dressings I found them soaked with a quantity of dark liquid fecal matter.

The wound had opened throughout its length and there were great masses of necrotic muscle and fascia. I suppose she got rid of probably a pint of fecal material, and I hoped that its removal might bring about some improvement in its condition, but was informed later that she gradually sank and died this evening. She had no further obstructive symptoms at any time and her abdomen was not distended when I saw her; on the contrary it was scaphoid. I think that there is no doubt that this death resulted from toxæmia, the result of extravasation of intestinal contents around the anastomosis.

There are a number of practical points in regard to resections of the colon about which there is great variety of opinion and practice, and most of these points are brought out in the foregoing cases. Using these as a basis, I propose to discuss the following questions. First, where should incision be made in operating for diseases of the colon? Second, is one justified in doing a resection and an anastomosis in the presence of acute obstruction, or should the obstruction first be relieved by drainage? Third, what are the relative merits of end-to-end and lateral anastomosis? Fourth, what is the best method of making the anastomosis? Fifth, should drainage be used if the peritoneum is not already infected? Sixth, to what is the operative mortality due? Seventh, is ultimate mortality due to too limited excision of the bowel?

1. In answering the first question I would say that the incision should be made as nearly as possible over the growth, and if one has been unable to locate the growth, and operates simply for the obstruction, and finds that he is unable to gain ample access to the involved bowel, then a second incision, through which the bowel may easily be drawn, should be made. A second incision is much less objectionable than the injury to the bowel through an incision which does not permit of easy handling.

2. Regarding the second question, as to resection and anastomosis in the presence of obstruction, there can be little doubt, all surgeons having agreed that however easy the

operation is it should never be done. This conclusion was reached after sad experiences, to which I think my first and second cases and possibly my tenth case, might be added. In 1903 F. T. Paul (*Brit. Med. Jour.*, Aug 15, 1903) said that obstruction more than trebled the danger of colon resection, and he reminded us that even after a simple colostomy, done for obstruction of two or three days' standing, the patient may be in a precarious state for two or three weeks, even though apparently greatly improved for twenty-four hours. There is sufficient auto-intoxication, even when the drainage operation is done fairly early, to cause severe poisoning which is characterized especially by a foul diarrhœa, loss of appetite, slight fever and general depression. This condition is well shown in Case VIII of my series, and is a picture, I am sure, familiar to us all. Not only is the patient absorbing toxins from the intestinal fermentation, but ulceration of the colon, well above the obstruction, in these cases is quite common. To do a formal resection, however quickly and easily, at this time is to invite disaster. Moynihan ("Abdominal Operations") says, "There are few rules so binding upon the surgeon as that which prohibits the resection of growths and subsequent end-to-end anastomoses of the large intestine in cases of acute obstruction." One is strongly tempted to break this rule when the growth is easily accessible, as it is in the transverse and sigmoid colon, but there is every reason why he should refrain. Experience has taught surgeons everywhere this lesson, and it should not be forgotten.

A few successful resections and anastomoses of the upper portion of the small intestine for acute obstruction may mislead the operator to the false conclusion that the same procedure will work as well in the case of the colon, but the question is an entirely different one. The small upper portion of the intestine is comparatively free from bacteria, while the tract of the large intestine teems with them, and it is this fact that accounts for the peritonitis so frequently observed in cases of long standing obstruction of the lower intestine. The bowel wall becomes distended, its circulation bad and the organisms make an easy exit into the peritoneal

cavity. It is a well-known fact that the lower down in the intestinal tract an obstruction is the greater is the infection from the absorption of the intestinal contents, and this is due not to the greater absorbing area but to the greater number of pathogenic organisms in the lower portion of the small intestine and colon. Numerous have been the contributions to surgical literature in recent years showing the danger of this absorption even after a perfect resection and anastomosis. Monks and others have laid great stress upon the importance of emptying the bowel above the obstruction at the time of the operation, and his work and experiments in this matter have contributed largely to our improved results. He has shown us how a large portion of the small intestine can be emptied by puckering the intestine up on a large blunt tube passed into its interior, and that this is the only way in which it can be accomplished. The toxicity of the intestinal contents in acute obstruction is well shown by the experimental study made by Clairemont and Ranzi ("Proceedings of the German Medical Congress, 1903"; ANNALS OF SURGERY, December, 1903.). Their results are as follows: "The intestinal contents above the stenoses, after being rendered free from bacteria by filtration, always proved poisonous, whether administered intravenously or hypodermatically. Bouillon cultures of small quantities of the intestinal contents after four to five days gave toxins equally poisonous. Thus the poison is the result of bacterial growth. It can also withstand heat. The toxic action can be paralyzed by mixing the material with the brains of normal rabbits or guinea pigs. The filtered intestinal contents in some instances showed intense hæmolytic power when administered to dogs or horses. It was impossible to establish either active or passive immunity to the poisons, which seem to show that an extension of serumtherapy to the treatment of ileus is impossible." William J. Mayo (*Jour. Amer. Med. Assoc.*, September 14. 1907) says that a fair proportion of the mortality following resection for obstruction is due to perforation from thrombosis, and he therefore urges great care in the handling of the distended bowel on this account. He advises tracing the

collapsed bowel up to the obstruction rather than the distended bowel down to the obstruction. Here, then, we have another reason for primary drainage of the large intestine in cases of obstruction before doing an anastomosis.

I think my own cases bear out all these points. In two I did a resection in the presence of an acute obstruction and lost both. In two others I did the drainage operation first and the resection later. One died and one recovered. In my last case I did a primary resection because I thought that as the obstruction was not complete there would be little danger from auto-intoxication, the result of absorption. As I have said before, this, I believe, was an error. What then should be the procedure in these cases of acute obstruction? Moynihan recommends Paul's operation, which consists in loosening the bowel from its attachment, bringing the growth out through the wound, dividing the bowel well above and below the growth, and inserting into the proximal and distal ends two glass tubes connected with a rubber drainage tube, and then the removal of the growth. By this operation the growth is removed at once and free drainage of the bowel is accomplished. Later, an anastomosis is accomplished by a crushing forceps and the fecal fistula closed. Von Mikulicz, Hartmann, and Mayo, all suggest methods quite similar to those of Paul. There is no doubt that these methods are superior to colostomy performed above the growth, as it renders subsequent operation very simple and easy. Where the growth cannot be delivered easily into the wound colostomy may be done or the obstructed portion of the colon may be side-tracked by performing ileocolostomy or colocolostomy. This method I pursued in one of my successful cases (Case VII). These operations are particularly advised where the obstruction is only partial, and sometimes are advantageous where there is no obstruction.

3. The relative merits of the end-to-end and lateral anastomoses depend largely upon the portion of bowel with which one is dealing. As a rule there is greater likelihood of leakage in the end-to-end operation because of the difficulty of getting an accurate and tight approximation of the two por-

tions at the mesenteric attachment. It can, I think, be said that unless the peritoneal coat can be brought in from the two lateral aspects and made to cover the divided mesenteric attachment a lateral anastomosis should be done. In the ascending and descending colon, and at the hepatic and splenic flexures, a large portion of the posterior aspect of the bowel has no peritoneal coat, and the mesentery is short and wide, so that here there is no chance of making a complete peritoneal approximation in an end-to-end anastomosis, and therefore the lateral method must be employed. In the transverse and sigmoid colon the entire bowel is covered with peritoneum, and it can be drawn in over the mesentery. It is only in these situations that the end-to-end method should be used. Even in the transverse colon and the sigmoid, I would prefer the lateral approximation. In resection of the cæcum, the ileum should be anastomosed with the transverse colon under the omentum, and by the lateral method. End-to-side anastomosis is more difficult and not, I think, as satisfactory. Another great advantage of the lateral anastomosis is that if properly done there is little drag upon the line of suture. In order to prevent this drag the two portions of bowel beyond the anastomotic opening in both directions should be approximated by several interrupted sutures. Many of the failures due to leakage in end-to-end anastomoses have occurred because an unhealthy portion of bowel was involved in the anastomosing sutures. This is much less likely to occur in the lateral anastomosis, and the surgeon knowing that he is going to perform a lateral anastomosis is much less likely to leave any of the diseased bowel. The argument that more time is required for the lateral anastomosis, is without weight as a rule. Still another point in favor of the lateral anastomosis is that there is no danger of stricture developing at the line of anastomosis, as there certainly is in an end-to-end suture. Moynihan lays great stress upon the importance of dividing the bowel obliquely, especially where an end-to-end anastomosis is to be made, as in this way there is less danger of including in the sutures a portion of intestine the circulation of which may be impaired. He

reports that he has done seven resections of the cæcum and ascending colon with end-to-end anastomoses. In this series there was one death due to leakage. His more recent practice is to employ the lateral anastomosis. Bilton Pollard (*Brit. Med. Jour.*, Jan. 23, 1904) advocates the end-to-end method and reports several successful operations done for carcinoma. Another strong advocate of operating in two or more stages is Neumann (*Deut. Med. Wochenschr.*, xxxii, No. 14), who details six cases of carcinoma of the colon in which he first practiced drainage and later resection. His results would certainly warrant his conclusions. Jonas (*Jour. Amer. Med. Assoc.*, Sept. 15, 1906) reports 16 cases of cancer of the colon in 15 of which resection was done. In this series he had 12 operative recoveries and three deaths. The three deaths were all due to a leakage at the point of anastomosis, and in each of these a Murphy button had been used.

In the first three of my own cases I did an end-to-end anastomosis; death occurred in one eight hours after operation, and leakage in the other two; in one a Murphy button was used, and perforation took place and the button dropped out of the bowel into a pocket behind it. Death occurred on the twenty-third day. In the third case simple suture was used, and the patient recovered in spite of a fecal leak and remains well to-day. In the last seven cases lateral anastomosis with simple suture was done. Leakage occurred in three and death in two cases. One died on the twenty-fifth day and one on the fourteenth. My own experience, then, tends to confirm that of the other operators already quoted who favor lateral anastomosis.

4. As regards the best method of making the anastomosis, I would say that it is difficult and practically useless for one operator to say what is the best method of suture to be employed by another in making intestinal anastomoses. I would advise one to use that method with which he is most familiar and which has given him the best results. There is one exception to this statement, however, and that is that some method of suture is far preferable to any mechanical device such as a button or a bobbin. I employed the Moynihan

operation, done with the aid of the Doyen forceps, in all of my cases excepting Case III, in which the Murphy button was used with subsequent necrosis and perforation. In my recent cases I have used a through-and-through suture of catgut and reinforcing suture of celluloid thread or silk. Some such forceps as those of Doyen facilitate the operation considerably, as they control the fecal current and also enable the operator to manipulate the bowel with the least possible traumatism. I have never used the Magraw suture, but those who have speak well of it. Most surgeons have now become convinced that the large intestine is no place for the Murphy button, and no one has tried to impress this upon the profession as much as Murphy himself. He states ("Year Book of Surgery, 1908") that for years he has advised against the use of the button in large intestine anastomoses excepting possibly in lateral anastomoses high up in the colon, and in these cases the oblong button should be used. This advice probably answers the question as to the utility of the button in these cases—and my own experience confirms it. Numerous cases have been reported in which the button has either become blocked by a mass of fecal matter, or in which pressure from it has produced necrosis and leakage. This is well illustrated in my second case.

5. Should drainage be used if the peritoneum is not already infected? This question is not so easily answered. Given a case in which there is no obstruction, no peritonitis, the bowel wall healthy at the lines of resection, and the intestinal tract well emptied before operation, I should use no drainage. This proposition, however, presumes an early diagnosis, which is by no means a rule in cancer of the colon, and a thorough preparation of the patient before the operation. In but two of my cases did I close the abdomen without a drain; one got well in spite of a leak, and is well to-day, four years after operation; the other died on the fourteenth day with leakage due to sloughing of the bowel at the line of approximation. This was Case X, and I believe that it might have been saved had a Paul's operation been performed instead of an immediate anastomosis. In the

eight other cases I used drainage and had a fecal leak in but three; one was the case in which the Murphy button was employed, and who died on the twenty-third day; another recovered in spite of the leak, and the third died on the fifth day. I believe that leakage does not depend so much on drainage or no drainage as on the character of the intestine and the accuracy of the suture. My own greatest error in this series was in doing resections without first draining the bowel thoroughly, the result of which was that the proximal portion of the bowel was in poor condition and the anastomosis put to the severe test of having to stand at once the strain of the passage of hard masses of fecal matter and a quantity of irritating and septic intestinal contents. I believe on the whole that drainage is better than no drainage in large intestinal anastomoses. The drain should be a small one and should not rest directly upon the line of suture, as this only invites a leak.

6. To what is the operative mortality due? One of the surprising lessons learned from the study of my own cases and from those of others is that the immediate operative mortality is remarkably small, and that the late operative mortality is large. In my ten cases I have had five operative deaths. Case I died eight hours after his operation, when he was suddenly taken ill with cardiac symptoms. At the autopsy in this case the patient was found to be suffering from a marked endocarditis; he also had a large aneurism of the thoracic aorta. Dr. Longcope thought that the cardiac condition alone was enough to account for the sudden death. There was peritonitis at the time of operation in this case, and even if the patient had not died of his cardiac condition I think that he might have died of the peritonitis. Case II died on the twenty-third day after operation, from infection due to necrosis of the bowel with fecal leakage. Case VI died on the sixth day after operation, apparently from septic intoxication. Case VIII died on the twenty-fifth day after operation, from a low grade infection and fecal fistula. Case X died on the fourteenth day from the same cause. It will be observed that there was but one prompt death after the

operation, and that from a cardiac condition, and that there were but two deaths within the first week. It is apparent, then, that the operative mortality is due to conditions which do not produce death under a number of days. In other words, the shock in spite of the prolonged operation, the age of the patient and even his bad condition, is not a significant factor in the mortality. The deaths result most frequently from necrosis of the bowel and leakage, and this necrosis in most instances is due not to a faulty method of suture but to the fact that the proximal portion of the bowel is in bad condition from either complete or incomplete obstruction. I am convinced that if the bowel was drained more frequently before the anastomosis was done the operative mortality would decrease considerably. The best operative results have been obtained where this primary drainage was employed. Moynihan has collected 100 cases of resection for malignant disease of the colon from recent literature, the results of which are particularly interesting. In 68 cases a primary resection was done with 22 deaths, a mortality of 32.3 per cent.; in 12 Paul's operation (resection and drainage followed later by anastomosis) was done with one death, a mortality of 8.3 per cent.; in 17 colostomy was done first and resection later, with 3 deaths, 17.6 per cent.; in 3 ileocolostomy followed by excision, one death, 33.3 per cent. The ultimate results in these cases are given in answer to the last question.

7. Is the ultimate mortality due to too limited excision of the growth? I do not believe that it is. Most of the recurrences that have taken place have not developed at the site of the previous resection. It is well known that glandular involvement in carcinoma of the colon takes place very late as compared with malignant disease elsewhere. In fact, obstruction often occurs before any extensive glandular involvement has taken place. Again, we all realize the importance of going well above the seat of disease, and many times we are compelled to make wide excisions because of the poor circulation of the proximal portion or because of the inaccessibility of the colon near the growth. In cancer of the cæcum the entire ascending colon should be removed, if for no other

reason than because an anastomosis between the ileum and transverse colon is better than an anastomosis between the ileum and the ascending colon. In cancer of the hepatic flexure the ascending colon and cæcum should be removed for the reason that ileocolostomy is of easier performance and produces better results than an anastomosis between the ascending and transverse colon. William J. Mayo reminds us that in 4 cases out of 5 the middle colic is the sole blood supply of the transverse colon, and unless these vessels are involved they should be preserved, else the whole transverse colon will become necrotic. In my series of 8 resections for cancer 3 recurred and one died one year after operation from recurrence without obstruction. Case IV died nearly two years after the excision of the cæcum for tuberculosis and 20 days after a second excision of the transverse colon for the same condition. Three patients are well at the present time. Case III, one of carcinoma, is well four years and two months after operation; Case VIII, one of carcinoma, is well fourteen months after operation, and Case IX, one of tuberculosis of the cæcum, is well four months after operation.

In close accord with my own results are those reported by Völcker (*Presse Médicale*, Oct. 10, 1908; "Year Book," Murphy, 1909) from the Heidelberg Clinic. He gives a study of 101 cases of cancer of large and small intestine, and concludes his paper with the statement that resection of the cancerous intestine is a very serious operation (50 per cent. mortality), but the patients surviving have a good chance of permanent cure (10 out of 17 survivors, 58.8 per cent.). In Moynihan's table of 100 cases he referred to the after history as given in 64 of the 73 cases which recovered from the operation: 17 were well at the end of six months; 15 at the end of one year; 15 at the end of two and a half years; 4 at the end of three years; 2 at the end of four years; one at the end of five years and 2 at the end of seven years. It will appear, then, that if we can improve our operative mortality our ultimate mortality will compare favorably with that following operations for carcinoma elsewhere.

# LARGE PHAGEDENIC ULCER OF ABDOMEN.

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OF NEW YORK CITY.

WE use the word "phagedenic" in the title advisedly, for lack of a better term to describe a rapidly progressing ulcer of a gangrenous nature. Most text-books of to-day describe phagedenic ulcers in the past tense, so to speak, and put the condition in the same category as malignant syphilis, hospital gangrene, malignant œdema, etc., usually ending by saying that the condition is "chiefly found in tropical countries," "is rarely seen to-day," and is accompanied by "great pain and high fever," etc. Gangrene in some form or other is an ancient disease; it is mentioned in the papyrus Ebers, and both Hippocrates and Galen describe and recommend treatment for this condition. That the case herewith reported is nevertheless a rare one to-day, is substantiated by the fact that in a very large and active hospital and clinical service of fourteen years we do not recall seeing a similar case. This, together with the very unusual site and extraordinarily large size, engages special interest.

CASE.—A. K.; fifty-five years old; gardener by occupation; was admitted to my service at Harlem Hospital May 30, 1908, with the following history. Six days ago picked with finger nail a small pimple on skin of the lower part of abdomen on the left side. The following day noticed that a scab had formed over this point, which upon removal with finger nail disclosed a small ulcer. This ulcer has been rapidly increasing in size ever since, and is accompanied by intense itching and considerable pain. Denies gonorrhœa or syphilis.

*Physical Examination.*—Male adult, medium frame, poorly nourished, conscious, rational, but very irritable and excited and in great pain. Pupils react sluggishly; mucous membranes pale but moist; tongue coated; pharynx red; pulse fair size and force, tension above normal. Heart sounds of fair force; lungs clear;

liver, spleen, and kidneys normal; reflexes diminished; no bone pains or tenderness. Abdomen hard, somewhat retracted, and presents an ulcer with its centre on about the lower one-third of a line between the umbilicus and the anterior inferior spinous process of the ilium, oval in shape, longest diameter transversely, about 2 x 3 inches in size.

The centre of the ulcer presented a small round area of grayish, sluggish, low grade of granulations, about one inch in diameter. Surrounding this was a black ring of gangrenous skin, dry outside, moist and undermined and irregularly attached beneath, with small honey-combed sacculations of thick sloughy pus. The outer edge of this black ring was rather firmly attached to the adjacent skin, and although the demarcation was sharply defined, it would bleed if detachment were attempted. The circumferential adjacent skin was red, slightly raised and inflamed, but not undermined.

The ulcer was irrigated with hot potassium permanganate, 1 : 10,000 solution, and dressed with bichloride solution, but it continued to spread with, almost visible, frightfully rapid progress from day to day, always preceded by the ring of juxtaposed inflamed skin. Vigorous antispecific treatment exhibited without effect. Temperature continued high, pain great.

June 6, 1908, ulcer measured 4 x 8 inches; June 10, measured 5¼ x 10 inches. It was observed that the ulcer, while it remained more or less oval, spread transversely across the abdomen with considerably more rapidity than in an ascending or descending direction, and when the lower border of the ulcer reached the hair line of the pubes, its downward encroachment apparently was entirely checked; although it continued to spread upwards towards the umbilicus, it did so slowly. In other words, after the lower border of the ulcer was halted at the hair line, its extension or progress was upwards in an eccentric rather than concentric manner.

This upward and lateral extension of the ulcer cannot be explained on anatomical premises, for the extensive network and stems of the subcutaneous lymphatics of the abdominal wall below the umbilicus, the infra-umbilical region, pass downwards and forwards, parallel with the ilium, and empty into the inguinal nodes. So it will be seen that the more rapid spread of the ulcer, contrary to what might be reasonably expected, was against the

FIG. 1.

Phagedenic ulcer of abdominal wall.

FIG. 2.

Cicatrix after healing of ulcer.

lymphatic stream. It is indeed a curious point in this connection to note that the inguinal glands were never enlarged.

June 9, a blood count showed only a very moderate leucocytosis: W.B.C. 12,000, R.B.C. 4,200,000; differential: polymorphonuclears 78 per cent., lymphocytes 17 per cent., mononuclears 4 per cent., eosinophiles 1 per cent.

June 2, 1908, culture made from ulcer showed presence of *Staphylococcus aureus.* June 4, 1908, Dr. Humphreys, the hospital pathologist, reported diagnosis:

"*Phagedenic Ulcer of Abdominal Wall.*—Film preparations from purulent material at centre of slough show many pus cells, very many staphylococci, and a *few* long spindle-shaped bacilli, the latter showing numerous clear spaces in their protoplasm (spores?). Aërobic culture shows merely *Staphylococcus aureus,* the bacilli failing to grow. Similar preparations made from serosanguinous discharge at edges of ulcer show many more spindle bacilli, indicating that these are the primary infective agents. Anaërobic cultures taken and will be reported later. In my opinion, the infection probably belongs to the heterogeneous class, known as soil or dirt infection, to which belongs chancroid, phagedena, malignant œdema, etc. The organisms of this class in general are anaërobic spore bearers, inhabiting rich soil, etc. Owing to the difficulties of artificial cultivation, their specific characters are but little known. The staphylococci are probably of only secondary significance.

"The patient's occupation, gardener, and the location of ulcer, waist band, as well as his general arteriosclerotic condition and poor nutrition, seem to me to be of especial significance in this connection. No spirochæte to be demonstrated."

June 6, Dr. Humphreys reported: "Anaërobic culture overgrown by *Staphylococcus aureus.*"

The ulcer continued to spread, resisting all external and internal treatment administered, including some highly reputed, especially efficacious "special treatment for ulcers," until June 12, when it measured 5¼ x 10¼ inches, reaching as it did from near the anterior superior spinous process on the right across the abdomen to beyond the same on the left. Temperature 104°, pulse rapid, patient delirious and rapidly becoming seriously and profoundly asthenic.

June 13, it was decided to treat the case wholly on surgical

grounds and to totally ablate the ulcer by actual cauterization. Patient was etherized. The entire ulcer, including the skin beyond the inflamed ring, was thoroughly cauterized. The extent and magnitude of this procedure can be more fully grasped when we mention that we consumed the benzine of two freshly filled Paquelin thermocauteries in a period lasting fifty-five minutes. The cauterized surface was thoroughly swabbed with pure carbolic acid, which in turn was washed with alcohol, and a mild bichloride wet dressing applied.

Reaction after the operation was complete, nice clean granulations quickly replaced the eschar, cicatrization was rapid, patient began to improve in every way. Temperature normal in a few days after operation, and recovery was complete and rapid, without a single setback in the way of a reappearance of the former disease.

Fig. 1 shows ulcer nearly at its height of development; Fig. 2, ulcer healed. Note the small size of the contracting cicatrix.

*Conclusions.*—Procrastination and temporizing with ineffectual internal medication and external dressings came near to losing the patient. Such rapidly extending ulcers should at once be thoroughly ablated with the actual cautery.

# INGUINAL HERNIA IN THE FEMALE.

BY WILLIAM B. COLEY, M.D.,

OF NEW YORK,

Attending Surgeon to the General Memorial Hospital; Associate Surgeon to the Hospital for Ruptured and Crippled.

INGUINAL hernia in the female constitutes a fairly large percentage of the total number of cases of hernia observed. At the Hospital for Ruptured and Crippled during the last twenty years, we have had 59,404 cases of inguinal hernia of which 9082 were in the female.

Championniere was the first to point out the excellent results that could be obtained by operation, and was one of the first to report a considerable number of cases.

With the help of Dr. D. H. M. Gillespie, I have made an analysis of 1692 cases of inguinal hernia in the female observed at the Hospital for Ruptured and Crippled, with the view of determining, as far as possible, at what period of life the hernia occurred. A special effort was made to ascertain in how many cases of hernia in adult life the hernia had existed in infancy or early childhood. These statistics show that it had so existed in 66 out of 1085 cases, or in 6 per cent. of the cases. It is probable that in a very considerable number of other cases the hernia had actually been present during infancy or childhood, but had been forgotten in the long interval that had elapsed.

TABLE I.—AGE OF PATIENTS AT TIME OF FIRST VISIT TO THE HOSPITAL.

| | Single. | Double. | Total. |
|---|---|---|---|
| Up to 1 year of age | 140 | 24 | 164 |
| 1 to 5 years of age | 171 | 21 | 192 |
| 5 to 10 years of age | 150 | 32 | 182 |
| 10 to 14 years of age | 56 | 4 | 60 |
| 15 to 21 years of age | 83 | 11 | 94 |
| 21 to 31 years of age | 164 | 30 | 194 |
| 31 to 41 years of age | 254 | 57 | 311 |
| 41 to 51 years of age | 177 | 54 | 231 |
| Over 51 years of age | 185 | 70 | 255 |
| Age not stated | 6 | 3 | 9 |
| | 1386 | 306 | 1692 |
| | | | 609 |

TABLE II.—CASES KNOWN TO HAVE HAD A HERNIA AT 14 YEARS OF AGE.

| | Per cent. |
|---|---|
| 34 of 94 between 15 and 21 years of age | 36.1 |
| 19 of 194 between 21 and 31 years of age | 9.8 |
| 8 of 311 between 31 and 41 years of age | 2.5 |
| 2 of 231 between 41 and 51 years of age | .8 |
| 3 of 255 over 51 years of age | 1.2 |
| 66 of 1085 cases | 6. |

## ANATOMICAL VARIETIES—INDIRECT OR OBLIQUE HERNIA AND DIRECT HERNIA.

Some writers [1] state that direct hernia in the female is even more frequent than in the male. Our observations at the Hospital for Ruptured and Crippled are entirely at variance with this view. In making an estimate of the relative frequency of the two varieties one can consider only such cases as have been subjected to an operation, inasmuch as a positive diagnosis cannot be made without operation. Yet, the writers who believe that direct hernia in the female is comparatively frequent, pass their opinion upon a clinical diagnosis alone, unconfirmed by operation.

I have personally operated upon 353 cases of inguinal hernia in the female, of which 170 were adults and 183 children, and only 2 in this entire series were direct herniæ. Both of these cases occurred in adults; one was operated upon six weeks ago, a double inguinal hernia with the bladder in the sac on the right side. This gives a proportion of six-tenths of one per cent., or, if we count the adults alone, as there are practically no direct herniæ in children, it is 1.2 per cent. Comparing this with the cases of direct hernia in the male, I have operated upon 1776 cases of inguinal hernia in the male, of which 815 were adults; 961 children. Of these I have observed 50 cases of direct inguinal hernia, or about 3 per cent. If we consider adults alone, which is the only correct way, we have 5.5 per cent. in male and 1.2 per cent. in the female, which would make direct hernia in the male occur 5 times more common than in the female.

[1] Escher, Deutsch. Zeit. f. Chir., 1899. B. iii, 53, H. 5.

*Etiology.*—I believe that inguinal hernia in the female, or at least all cases of oblique inguinal hernia in the female, are due to a persistence of the process of peritoneum known as the canal of Nuck, which corresponds almost exactly with the vaginal process of peritoneum in the male. That this process remains patent in many children long after birth, even into adult life, has been proven by a large number of investigators.

That the formation of the canal of Nuck is similar to the formation of the vaginal process of peritoneum in the male, is disputed by a number of writers, some, *e.g.*, Martin and Waldeyer, holding that this canal is a normal occurrence; others, like Duplay, believe it to be anomalous.

My own belief, based upon a careful study of 350 cases of inguinal hernia in the female, operated upon personally, is that the canal of Nuck is a normal development, which remains open in all cases in which a hernia subsequently develops as well as in many other cases that never have a hernia. This congenital process of peritoneum, by its failure to close I regard as the great and all-important cause of inguinal hernia in the female, as well as in the male, although in addition there are usually present various exciting causes, such as persistent crying in infancy and young children, straining of stool, heavy lifting, and coughing in adult life.

Karl Hemmerdinger in his inaugural dissertation (1902) speaks of the relation between congenital inguinal hernia and the descent of the testis or ovaries and the patency of the vaginal process of peritoneum in the male and the so-called Nuck's diverticulum in the female. He enters somewhat fully into the history of the development of the inguinal region, a knowledge of which is necessary in order to understand the mechanism of congenital inguinal herniæ.

Careful examination of an embryo eight weeks of age, shows at the lower end of the primitive kidney a second peritoneal fold running toward the inguinal region. This fold includes a rather coarse band of connective tissue, called the inguinal band, or cord of the primitive kidney. The same

plays an important rôle in the development of the male and female genital organs. In man it later becomes Hunter's gubernaculum; in woman, the round ligament.

The ovaries, the same as the testicles, undergo considerable change of location in their descent. In the third month of embryonic life they pass from the lumbar vertebra into the small pelvis. It is upon this descent of the ovaries that the above described inguinal band of the primitive kidney (which is also present in the female) is destined to act. During this process the inguinal band separates into three sections and enters into firm union with Müller's ducts at the point where they combine and form the sexual cord. The upper section, consisting of smooth muscle fibres, originates in the parovarium and is embedded in the hilus of the ovary. The continuation of this section is the ovarian ligament, and this, passing into the third and most highly developed section of the inguinal cord, forms the round ligament.

As to the origin of the canal of Nuck, Hemmerdinger believes that it is produced by the same causes that are responsible for the vaginal process in the male, even though there be apparent differences.

According to Bramann's observations, the vaginal process in the male originates in the following manner:

In the beginning of the seventh month of embryonic life a small indentation of the peritoneum occurs at the spot where the gubernaculum leaves the abdomen; at the same time the testicle passes into the scrotum. As the testis descends, the above-mentioned indentation becomes elongated. The same factor that causes the testicle to be drawn into the scrotum, elongates the small peritoneal sac lying before it. If this agent ceases to exert traction upon testicle and peritoneal sac, the latter's descent is arrested.

Thus, the peritoneal diverticulum is present before the testicle begins to traverse the abdominal walls. Hence, the vaginal process cannot be considered the result of a bulging of the peritoneum caused by the testicle. On the contrary, the testicle and vaginal process are united, and descend together.

The agent which draws downward the testicle and at the same time forms the processus vaginalis, has been called by Soulie, *un cordon cellulaire plein* (a plain, cellular cord). This cord may cause a diverticulum of the peritoneum and leave the testicle within the abdomen. Many of my cases prove the truth of this opinion.

In an analogous manner the same cord causes a protrusion of the peritoneum in the female, which is then called Nuck's diverticulum. Hence, both vaginal process and Nuck's diverticulum are due to the same cause in man and woman.

Herman Meyer of Zurich has made extensive investigations as to the relation of such peritoneal diverticuli to the development of inguinal hernia. He found in a new-born dog on either side of the abdominal wall an opening which led into a diverticulum 9 to 12 mm. in length; the same was situated outwardly and in front of the round ligament.

In the female fœtus of three to eight months, he found the same diverticulum six times, ranging in length from 1.75 to 10 mm., and in relatively the same position to the round ligament.

In new-born children and infants, Zuckerhandl found the canal of Nuck open in 37 per cent. of the cadavers examined; Féré in 9.2 per cent., sometimes on one side only, sometimes on both.

The reason many writers fail to recognize this canal is that the abdominal opening is difficult to find. Nobbe states that even in those cases in which the entrance to the vaginal process is relatively wide, the communication between the diverticulum and peritoneum is not always promptly found, as the cavity is covered by a fold of peritoneum and the transverse fascia. Only in the eighth cadaver examined (a girl three-fourths of a year old) was Nobbe able to recognize a canal of Nuck open on both sides. The diverticulum on the right side was 16 mm. in length and 3 mm. wide; the entrance opening was 8.5 mm. wide. On the left side the diverticulum was 17 mm. long; entrance opening 2.5 mm. and canal 3 mm.

According to Sachs the obliteration of the vaginal process is due to granulation.

Féré found in one case in the entrance opening a protruding mass the size of a millet seed, which he interpreted as an exudate causing the obliteration. This obliteration may be complete or partial, which enables one to explain the different shapes of the hernial sac in external herniæ and hydroceles.

As regards the frequency of the patency of the vaginal process of peritoneum, Hemmerdinger states that this increases with advancing age. In the first ten to twenty days after birth obliteration proceeds very rapidly and comes to a completion in about 50 per cent. of the cases. From the twentieth to the thirtieth day after birth, the number of cases with total obliteration is much smaller, while there is a marked increase in the cases with an entirely open vaginal process.

Camper found in a series of 70 new-born babies, both vaginal processes open in 34; the right vaginal process in 14 and the left vaginal process in 8 cases.

Zuckerhandl examined 100 children during the first three months of life and found in 57 infants an unobliterated vaginal process on both sides in 20; on the right side in 12 and on the left side in 5 cases. In 188 children up to 3 years of age, examined by Féré, the vaginal process was found partially obliterated on both sides in 11, on the right side in 16 and on the left side in 14. In 18 obliteration had not taken place at all.

Of these 59 cases 32 were below 1 month of age, 6 from one to three months and only 10 were above six months.

From the above investigations it appears that the vaginal process of peritoneum becomes obliterated earlier on the left than on the right side, which may be explained by a later descent of the right testicle.

Similar conditions obtain as regards the canal of Nuck in the female. Hugo Sachs who examined 100 children within the first year states " The persistence of the canal of Nuck

is much rarer than that of the vaginal process in the male. In 75 per cent. of these children Nuck's diverticulum was obliterated at the moment of birth. Whenever it was not obliterated at that time, it showed very little inclination to become obliterated later."

Nobbe arrives at the following conclusions, based upon his own investigations as well as a study of the literature: (1) The canal of Nuck is found in about 8 to 10 per cent., while the vaginal process is found open in 30 to 40 per cent. (2) Obliteration occurs usually post partum, rarely ante partum. (3) The diverticulum is generally found open on both sides; more rarely it is found open on one side. If the canal does not become obliterated, it represents a preformed passage-way for the herniæ.

Frequently the cavity of the vaginal process in the female becomes filled with a serous fluid (hydrocele muliebris).

Hemmerdinger reports the history of a case of hydrocele in the female observed at the Freiburg Clinic. Hydrocele in the female is not so exceedingly rare as was formerly believed. Wechselmann [2] in 1890 reported 62 cases, and in 1892 I published 15 cases observed at the Hospital for Ruptured and Crippled. In 353 adult cases of inguinal hernia in the female which I operated upon, hydrocele of the canal of Nuck was found in 11 cases.

As regards the etiology, I believe with Hemmerdinger, that hydrocele of the canal of Nuck is due simply to a failure of the diverticulum of Nuck, or the processus vaginalis, to completely close. The condition is really never more than an accumulation of fluid in the lower end of an actual or potential hernial sac.

E. Scott Carmichael of Edinburgh, has contributed some valuable facts upon inguinal hernia in the female (Trans. of the Medico-Chir. Soc. of Edinburgh, 1905–6, p. 226). His conclusions are based upon a statistical study of 729 radical operations in both sexes, treated by Harold Stiles and

[2] Arch. f. klin. Chir., 1890, 40, 578.

himself. In this series of cases 5 to 10 per cent. occurred in the female. In 184 radical cures performed by Carmichael in children, 23 were females. Of the 729 radical operations in both sexes, 76 were in girls, giving a percentage of 10. 21 were under one year of age; 21 were under five years of age, and 34 were over five years of age. 39 were on the right, 24 on the left side, and 13 double.

A study of the contents of the sac is of great interest. The following contents were either found in the sac or could be pulled down into the sac in 28 cases:

| | |
|---|---|
| Fallopian tube and ovary | 17 |
| Fallopian tube alone | 5 |
| Small intestine | 2 |
| Omentum | 2 |
| Cæcum and ovary and Fallopian tube | 1 |
| Vermiform appendix and ovary and Fallopian tube | 1 |

In two cases the sac was tuberculous.

Carmichael states that it is suggestive that the persistence of the so-called canal of Nuck should be associated in such a large percentage of cases (over 30 per cent.) with malposition of the ovary and Fallopian tubes. In the young child the position of the ovaries and tube shows great variation. Sometimes the ovary lies longitudinally along the lumbar vertebræ, resting on the psoas muscle; again, it may be found on the false pelvis or in the cavity of the true pelvis. Carmichael believes that the action of the gubernaculum or inguinal ligament may be in some way responsible for the position of the ovary. He does not believe that it is possible to explain the presence of the ovary and Fallopian tube in 24 cases out of 28 by simple mechanical causes, but thinks that in some way it is associated with the development of the inguinal ligament. That the formation of the canal of Nuck is analogous to the processus vaginalis in the male, Carmichael believes to be doubtful.

He regards the canal of Nuck an abnormal protrusion, associated with the development of the inguinal ligament. He points out the fact that the ovary and tube do not lie

free in the sac in the same sense as a loop of intestine and omentum, but are intimately associated with its wall, the broad ligament or mesosalpinx springing directly from the posterior aspect of the sac. The relation of the ovary to the sac very closely resembles that found between the sac and the cæcum and sigmoid.

Lockwood regards ovarian hernia due to abnormal length of the mesovarium or mesosalpinx. Carmichael's series of cases does not support this view. His cases show a large percentage of inguinal hernia in the female to be bilateral. In babies under one year, of 21 cases 8 were double; of 21 under five years, 2 were double; of 34 over five years, 3 were double.

A much greater frequency of ovarian hernia in the very young is also shown by Carmichael's statistic:

In 21 under one year, ovary and tube were found in 13 cases; in 21 under five years, ovary and tube were found in 7 cases; in 34 over five years, ovary and tube were found in 2 cases.

The very large proportion of ovarian herniæ shown by Carmichael's statistic is probably due to the fact that 21 out of 76 patients were individuals under the age of one year; 21 others were under five years.

Practically all of my cases were over four years of age, and 170 of them were in adults. While I have seen a considerable number of cases in infants and young girls in which I was able to palpate the ovary, in only a very small proportion of the older patients was the ovary found at operation.

Bladder hernia in my own experience is an extremely rare condition in the female. My series of 350 cases shows only two examples of bladder hernia, both of the paraperitoneal variety. In both of these cases the hernia was of the direct type.

Eggenberger (*Deutsche Zeit. f. Chir.*, Oct., 1908) whose paper upon bladder hernia gives the most recent and most complete statistics of the subject, was able to add 110 cases to the 182 cases twelve years previously collected by Brunner. The sex is given in 241 cases, 168 of which were males, 73

females. While Brenneisen gives the proportion of male to female cases as 3: 1, Eggenberger's personal statistic shows a ratio of 3 males to 2 females. Of the male cases, 55 were inguinal, 5 femoral hernia; of the female cases 15 were inguinal, 23 femoral hernia.

I have personally never seen a cystocele in a femoral hernia. One of my cases, a large irreducible inguinal hernia, contained an incarcerated appendix with considerable fluid in the sac.

Tumors of the hernial sac, while found in both male and female, are much more common in the female, taking the form of a cyst, or the so-called hydrocele of the canal of Nuck.

Solid tumors of the inguinal canal are extremely rare. Kepler (*Boston Med. and Surg. Jour.*, Aug. 20, 1908) reports a case of dermoid cyst of the canal of Nuck and gives a very careful review of the literature. His case occurred in an unmarried woman, 26 years of age, who had worn a truss since childhood for a supposed right inguinal hernia. The hernia became apparently cured, but re-appeared two years prior to the date of the operation. The symptoms were strongly suggestive of catarrhal appendicitis with recurrent attacks. Examination showed a sausage-shaped painless swelling in the right inguinal canal which occasionally disappeared for a short time. This had been irreducible for about a year. Operation showed a mass occupying the canal of Nuck which could be displaced upwards about two inches. On opening the tumor there was an escape of much thick cheese matter with hair. Pathological examination was made by Dr. Leary of Tufts Medical College and showed it to be a cyst of the canal of Nuck. Microscopical examination proved it to be dermoid in character. Kepler's careful review of the literature showed this to be apparently a unique case.

I have seen one case of Fallopian tube in the sac of a femoral hernia. It was irreducible and very adherent. The patient was aged 29 years and the operation was performed February 4, 1909.

I have operated upon one case of multiple cyst of the canal of Nuck February 5, 1909. The patient was 41 years of age and had had a swelling of several years' duration in the right inguinal region; it had never been reducible. Operation disclosed four cysts of various sizes not communicating with one another, the uppermost one occupying the inguinal canal, separated from the abdominal cavity by a thin layer of peritoneum. The size and anatomical situation of the cysts are shown (Fig. 1).

*Unusual Cases of Inguinal Hernia in the Female.*—Inguinal hernia of tube and ovary, one case aged 12 years; one case aged 6 years; one case aged 3 years; one case aged 48 years. Strangulated hernia of appendix with large amount of exudate, one case, aged 35 years (Fig. 2). Double direct hernia with the bladder on the right side, one case, aged 55.

*Interstitial Hernia* (Case I).—*Strangulated interstitial hernia the size of a cocoanut, containing cæcum and ascending colon.* This case is so extremely rare, that it merits a detailed report.

Mrs. S., 40 years old, was admitted to the Hospital for Ruptured and Crippled in the afternoon of May 11, 1908, and operated upon immediately. She gave no history of ever having had a hernia, but three days before began to have pain and discomfort in the right lower abdomen, accompanied by almost complete obstipation, some nausea. The symptoms became gradually more severe. The nausea increased and was followed by slight vomiting. Before she was admitted to the hospital she had been examined by the house surgeon, who found a tumor in the right lower abdomen which was tender on pressure and irreducible. I saw her about an hour after admission; the pulse was 120, temperature 99.5°. While her general condition could not be called good, she did not show very marked prostration. She was fairly stout, with considerable adipose tissue in her abdominal wall.

Physical examination showed practically nothing abnormal on inspection. On palpation a tumor the size of a grape fruit or two fists could be made out in the right iliac region, extending up nearly to the level of the umbilicus and downward as far as the inguinal region. There was, however, no tumor either in

the inguinal or femoral canals. On coughing, a protrusion could be felt apparently coming through the internal ring and extending partly into the inguinal canal. The whole tumor seemed to be situated beneath the external oblique aponeurosis; it was tympanitic on percussion, resilient on palpation, symmetrical in outline, and quite irreducible. I made a diagnosis of strangulated interstitial hernia, from the anatomical position of the tumor, and believed the contents of the hernial sac to be cæcum, for, had the small intestine been strangulated for such a length of time, the symptoms would have been much more acute.

A long, oblique incision was made over the tumor. On cutting through the skin and superficial fascia, I came down upon a greatly distended external oblique aponeurosis, which was then incised. It disclosed a very large hernial sac which lay on the outer side, beneath the external oblique aponeurosis and on the inner side was situated partly under the external and partly under the external and internal oblique both and the transversalis fascia beneath, making it practically a properitoneal hernia. This sac was found to contain several ounces of slightly cloudy exudate, the whole cæcum and part of the ascending colon which were dark-colored but with no areas of necrosis. Under hot towels circulation became sufficiently good to warrant their return into the abdomen. The patient made an uneventful recovery.

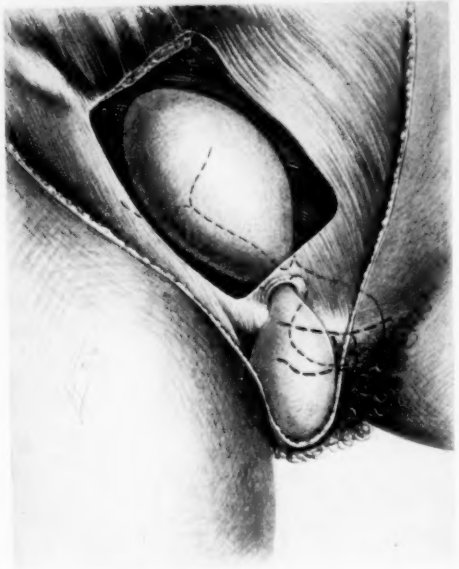
The strangulation was evidently caused by a strong fascial ring, apparently the internal ring and the intestine, after emerging from the internal ring, extended upwards instead of downwards until it had occupied the position already described (Figs. 3 and 5).

It seems to me the most probable explanation of the development of this hernia is, to regard the sac as a diverticulum of congenital origin.

There is another explanation which I formerly held to be the true one *i.e.*, to regard the sac as an acquired sac which had gradually taken the position found at operation because it had met with some obstruction in its downward course, and it simply followed the line of least resistance. This was the view held by Macready.

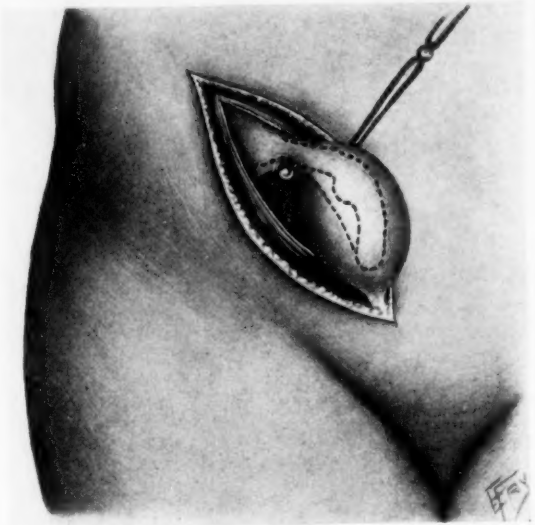
*Interstitial Hernia in the Female* is an extremely rare oc-

FIG. 1.



Multiple cysts of canal of Nuck.

FIG. 2.

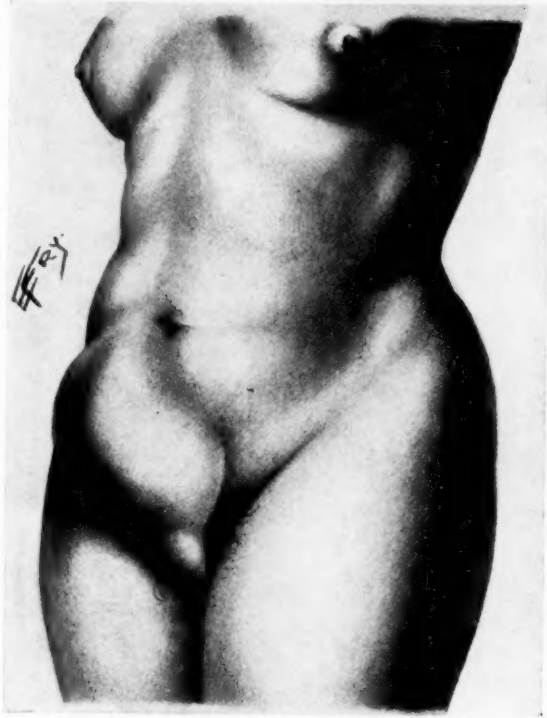


Incarcerated hernia of the appendix with sac distended with bloody fluid.

FIG. 3.

Strangulated interstitial hernia in the female.

FIG. 4.

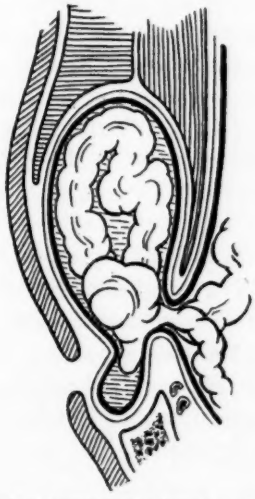


Interstitial hernia in the female, associated with hydrocele in the canal of Nuck. (Bull and Coley.)

currence and very few cases have thus far been reported. The first in this country was, I believe, the one reported by Dr. Bull and myself, in the *New York Medical Journal* in 1890. In this case the hernia was associated with a large hydrocele of the canal of Nuck which we at that time regarded as furnishing the mechanical obstruction which caused the hernial sac to proceed upwards beneath the aponeurosis of the external oblique (Fig. 4).

CASE II.—*Properitoneal Hernia in the Female.*—A. M., aged 49, with a history of having had more or less discomfort in

FIG. 5.



Interstitial hernia in the female. (Coley.)

the right iliac region for a number of years; had never worn a truss. In the middle of February, 1909, she came to the Hospital for Ruptured and Crippled with a swelling about the size of a goose egg or small orange in right iliac and upper inguinal region. The swelling had appeared suddenly ten hours previous to her coming to the hospital, and was accompanied by a good deal of colicky pain, but no vomiting. The swelling was reduced by the house officer without an anæsthetic and the patient returned home. Two weeks later she was admitted to the Hospital for Ruptured and Crippled under the diagnosis of inguinal hernia, although one of the surgeons who saw her in the out-patient

department regarded it as femoral hernia. The hernia was not down at the time of examination.

I operated upon the patient March 5, 1909, at the Hospital for Ruptured and Crippled. The usual Bassini incision was made over the inguinal canal; but on cutting down, I could find no enlargement of the external ring, in fact, I could hardly find an opening sufficiently large to introduce a director. This fact, together with the discovery of a mass of fat the size of an English walnut, in the femoral region, made me suspect an error in diagnosis and to think that we had really to deal with a femoral rather than an inguinal hernia. Careful dissection, however, of the mass of fat failed to disclose any sac whatever in the femoral canal. I thereupon opened the aponeurosis of the external oblique over the inguinal canal nearly to the level of the anterior superior spine and downwards through the external ring, which was not at all enlarged. Directly under the aponeurosis at the lower point, near the external ring, I found what proved to be a large hernial sac which extended upwards beneath the internal oblique muscle and the aponeurosis for a distance of at least 3 inches. On opening the sac it was found empty. The neck of the sac, about one inch in diameter, was situated at about the site of the normal internal ring. The anatomical situation of the sac between the internal oblique and transversalis fascia is well shown by the accompanying illustration (Fig. 6). The sac was removed, the opening in the peritoneum closed and the sheath of the rectus muscle was cut and reflected and, with the internal oblique, sutured to Poupart's ligament. The patient made an uninterrupted recovery.

The only other case of true properitoneal hernia in the female which I have been able to find in the literature in addition to the two cases in Göbell's collection, is the case reported by Sultan, in his paper on "The Mechanism of the Retrograde Incarceration of the Gut" (*Centralbl. f. Chir.*, Dec. 28, 1907), with three illustrations. In this case, however, no operation was performed. The condition was found at autopsy.

The patient, a woman 53 years of age, entered the hospital on September 19, 1907, with symptoms of perforative peritonitis. She was in a moribund condition at the time of entrance, so that it was impossible

to operate. She died one and one-half hours later. Autopsy showed a hernia in the right iliac region between peritoneum and fascia, *i.e.*, an inguinoproperitoneal hernia. The sac contained two loops of small intestine and a mass of omentum. The hernial orifice lay in the internal inguinal ring, yet there was no constriction at this point. The strangulated loop of bowel was situated in the abdomen proper, showing the rare condition of retrograde incarceration.

Cumston (ANNALS OF SURGERY, 1905, p. 427) in a paper upon Interstitial Hernia, emphasizes the fact that the condition is extremely rare in the female. Of the 69 cases of inguinoproperitoneal hernia collected by Göbell only 2 were in the female.

Our knowledge of interstitial hernia is based chiefly upon the exhaustive paper of Göbell (*Deutsche Zeitschr. f. Chir.*, Bd. lvi). Of 115 cases collected by Göbell, only 4 occurred in women.

Cumston states that in the 11 cases collected by him up to 1900, not a single one was found in the female. He reports a personal case occurring in a girl of nine. Shortly before operation she had symptoms which were supposed to point toward appendicitis, which disappeared on confinement to bed. The symptoms were believed by Cumston to point toward a partial strangulation, which was relieved by horizontal position. The operation disclosed a bilocular sac, the lower end extending into the labium, the upper occupying a position between the internal and external oblique muscles.

Auvray (*Gazette*, June 10, 1901) reported a case of interstitial hernia in the female observed in 1900, and this case was believed by Cumston to be the first recorded case. He had, however, overlooked the case operated upon by Dr. Bull in 1890 and published in detail by Bull and Coley (Fig. 4).

Another case was operated upon by Helferich and reported the following year by Müller. Fredet reported a case in 1901; two others were reported in the same year by Brunco, in his thesis.

*Intraparietal Hernia.*—A most interesting case of interstitial hernia observed at Helferich's clinic was reported by Müller in his inaugural dissertation (1901).

The patient, who claimed to have never had a hernia, suddenly noticed a tumor in the inguinal region after lifting a child. One month later the hernia became irreducible and the patient entered the clinic. The diagnosis of interparietal hernia was made and immediate operation advised. The latter revealed half of the sac in the labium major, the other half between the external and internal oblique muscle, external to the inguinal canal. Isolation of the interparietal part of the sac was easily accomplished, while that of the portion in the labium major caused considerable difficulty.

Müller states that outside of the above, only 11 such cases have been observed—all males; 5 of these were reducible; 5 incarcerated; 1 was found at autopsy; and all 11 were crytorchids. Müller considers the case reported by him of special interest, as he believed it represented the first well-authenticated case of a hernia situated between the external and internal oblique in a woman, and also the first case that was irreducible. He had overlooked the case of Bull and Coley published ten years before. He states that the narrowness of the inguinal canal in the female and its greater length as compared to that in the male, account for the relative rarity of inguinal hernia in the female.

According to Jobert, the right inguinal canal in both sexes is wider than the left, which explains the greater frequency of inguinal hernia on the right side, at least in the female. Both of my cases occurred on the right side, as also did Dr. Bull's case.

Müller states that inguinal hernia of congenital origin is more frequently observed on the right than on the left side, and he believes that in the case reported the hernia was probably congenital, although the patient was not aware of its presence. For, only the pre-existence of a hernial sac, as shown by the investigations of Roser, Linhart and English, renders the sudden appearance of a hernia possible. This is also my opinion, and the conditions found in both of my cases strongly confirm this view. In one case the lower loculus of the sac passed beyond an external ring too small to permit the passage of hernial contents.

The first exhaustive description of an interstitial hernia

was published by Goyrand in 1836. Göbell, in his work "On Interparietal Inguinal Hernia" (*Deutsche Zeitschr. f. Chir.*, lvi Bd.) gave a critical review of the literature of the subject and suggested a nomenclature which, Müller thinks, well worthy of general adoption. He distinguished complete and incomplete hernia, subdividing these into:

1. Inguinoproperitoneal hernia.
2. Inguinointerstitial hernia.
3. Inguinosuperficial hernia.

These might be further divided into monocular and biocular interparietal herniæ.

The monocular herniæ are usually congenital, while the bilocular may be either congenital or acquired.

The principal etiological factors in the development of these herniæ Müller believes to be (1) The anatomical structure of the canal; (2) An impediment (either mechanical or anatomical) to the passage of the hernial contents.

Inguinoproperitoneal hernia had been observed 69 times up to the writing of Müller's dissertation; 67 times in men and only twice in women. Only 7 were reducible; the remainder showed symptoms of incarceration, and in the majority of cases the hernia was not discovered until the time of operation.

The hernia was found on the right side in 37 cases; on the left, in 23; in 9 the side was not stated. Sixty of these herniæ were bilocular.

Of inguinointerstitial hernia, Müller found 200 cases reported. Of these 162 occurred in men, 38 in women. 129 and 34 of these respectively, are included in Macready's statistics of reducible herniæ. They were not operated upon nor was autopsy performed; hence, all anatomical data are absent. In the remaining cases the histories are sufficiently explicit to enable one to determine in which interstices of the muscles the sac was found. Most frequently it was noticed between the external and internal oblique, and of this variety, as has been stated before, only 12 cases (including Müller's) are known. My own case makes 13.

The rarest cases of inguino-interstitial hernia are those in which the sac is embedded between the fibres of the internal oblique muscle, or between internal oblique and transversalis fascia. My second case was of this variety.

Moynihan even claims that such herniæ have never been seen. It must be stated, however, that Goyrand, Berger and Venturoli have seen fibres of the internal oblique muscle anteriorly and posteriorly to the sac, in fact, Goyrand considers this a characteristic of this variety of hernia; in Berger's case the hernial sac was found within the thickness of the internal oblique, and Venturoli was obliged to sever the fibres of the internal oblique in order to reach the sac.

As interparietal herniæ are very apt to become incarcerated, radical operation is the best treatment.

Brunco (Inaugural Dissertation, 1904) reports two cases of left interstitial hernia in the female, operated upon by Graser of Erlangen.

CASE I.—A widow, 66 years of age, with a history of a small lump in inguinal region for three years, with rapid increase in size in last year. The hernia was found between the external and internal oblique muscles.

CASE II.—A woman, 46 years of age, with a history of severe attacks of vomiting during the past sixteen years, recurring at intervals of a few weeks to three months. Medical treatment was employed without relief. In the left groin a protrusion the size of the fist was found, extending from the external ring upwards towards the anterior spine of the ilium. On splitting the aponeurosis a hernial sac was found lying between the external and internal oblique muscle and containing a loop of inflated small intestine.

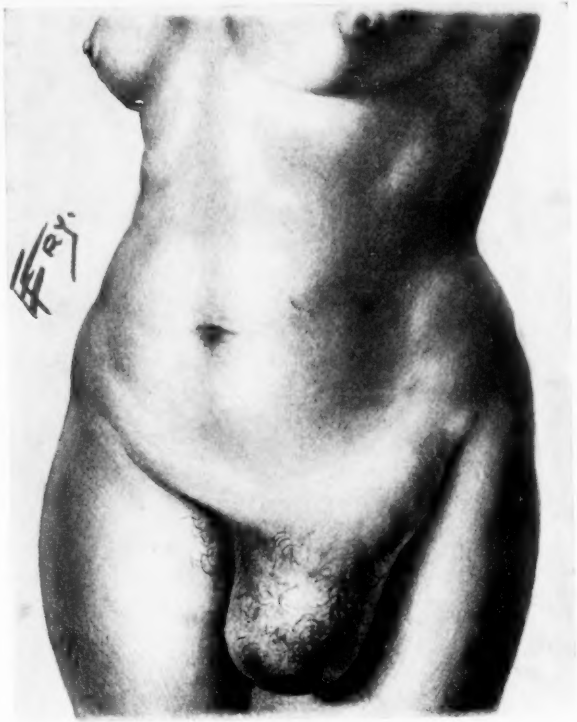
Brunco states that radical operation should be performed in all cases of interstitial hernia, since the prognosis in the cases not operated upon is unfavorable, far more so than in ordinary inguinal hernia, for the reason that they are very apt to become incarcerated. One half of Göbell's cases were incarcerated.

*Method of Treatment of Inguinal Hernia in the Female.*—In a considerable number of cases of hernia in the female in infancy and early childhood, the hernia is either cured by the wearing of a truss, or, in some cases, even spontaneously.

Fig. 6.

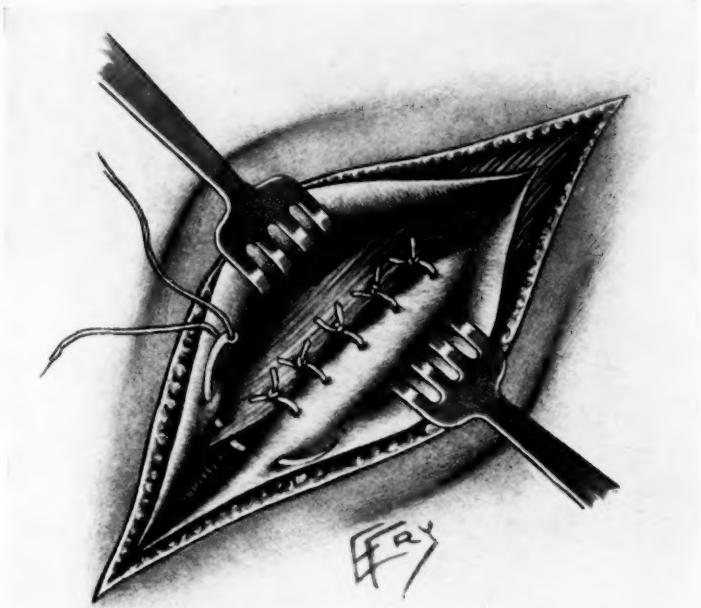
Properitoneal hernia (inguinal) in the female.

Fig. 7.



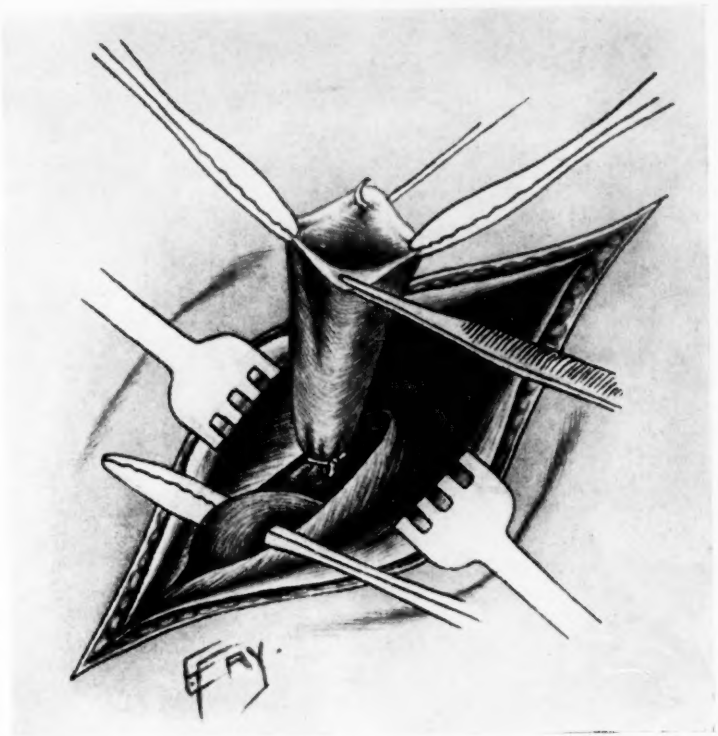
Labial hernia.

FIG. 8.



Modified Bassini method. Suture of the internal oblique to Poupart's ligament without transplanting cord. Note last stitch placed to include reflected aponeurosis. (Bull and Coley.)

FIG. 9.



Inguinal hernia in female, showing sac dissected from round ligament.

For this reason, I do not go so far as Stiles and Carmichael of Edinburgh and some of the French surgeons, notably Broca, in advising operation during this period of early infancy. The statement which I have already referred to, that our statistics at the Hospital for Ruptured and Crippled show 6 per cent. of adult cases of inguinal hernia in the female in which the hernia existed during infancy and childhood, although short of the actual truth, still show that a large number of the cases that occur in early life, are cured without operation, for we know that inguinal hernia in the female is far more frequent during infancy than at any other period of life. Personally, I seldom advise operation in children under the age of three to four years; first, because I prefer to give the child the chance of a mechanical cure, and, second, because there is little risk from strangulation at this age. I have never seen a case of strangulation in inguinal hernia in the female under the age of fourteen. In addition, should strangulation occur, the mortality of operation is very small. In 20 cases of strangulated hernia in children at the Hospital for Ruptured and Crippled, we have not had a single death. After the age of three to four years, we believe it wise to operate on practically all cases. The operation is simple, free from risk, and the child need not be confined to the bed more than 10 days or two weeks. Adults I usually keep in bed for two weeks and allow them to go home at the end of two and a half weeks.

*Method of Operation.*—The method of operation which I have employed has been the same in the entire series of cases, and consists in an operation practically identical with the modified Bassini operation which Dr. Bull and myself introduced at the Hospital for Ruptured and Crippled in 1892. (See ANNALS OF SURGERY, 1895, '97 and '98.) The only variation from the typical Bassini operation is that the cord is not transplanted, but allowed to emerge at the lower angle of the wound. In the female the round ligament is treated the same way as the cord in the male, in that it is left undisturbed at the bottom of the wound, the internal oblique

being sutured to Poupart's ligament; the aponeurosis is then closed and last of all, the skin as shown in Figures 8 and 9.

The transplantation of the round ligament as proposed and carried out by Howard Kelly ("Operative Gynæcology") at Johns Hopkins, is entirely unnecessary and has not given as good results as when it has been allowed to remain undisturbed.

Some surgeons, among them Championniere, have removed the round ligament along with the sac, for the reason that the dissection of the sac from the ligament is much more difficult than the dissection of the sac from the cord in the male.

However, with a little care, and going about the dissection in the right way, one can always separate the sac from the round ligament, and I have always done this, believing it unwise to unnecessarily sacrifice the ligament. The sac is then dissected high up beyond the neck and closed by transfixion with a catgut ligature, the wound being then closed in the way I have described in the modified Bassini operation (the Bassini method without the transplantation of the cord.

*Results.*—In this series of 353 cases, there has been no death and but two relapses, and the large majority of cases have been traced to final result. One of the relapses occurred in a woman 35 years old, two years after operation, and was brought on by very heavy lifting which, at the same time, caused a hernia on the sound side. The second relapse was anticipated, for the reason that the operation was performed in a woman seven months pregnant, 35 years of age, with a very large strangulated inguinal hernia the size of two fists. The sac and outlying tissues, including fascia and muscles, were infiltrated with exudate and the gut was in a precarious condition. The operation was performed as rapidly as possible and the wound closed with drainage. Extensive suppuration followed, and although the patient was delivered at full term of a healthy child, the wound had not become firm enough to stand the severe strain of childbirth, and relapse occurred shortly afterward.

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# SURGICAL ASPECTS OF CHRONIC HYPERTROPHIC ARTHRITIS.

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THE study of chronic disease of the joints has become enhanced in interest in recent years by the special attention given to those forms generally called rheumatoid arthritis or arthritis deformans. A perusal of the recent literature gives one the impression that the study of this disease is of comparatively recent date and that heretofore all chronic joint disease, not of distinctly infectious origin, was generally classed under the heading of chronic rheumatism. But although the use of the X-ray has made many of the symptoms and signs of the bony lesions more easily comprehended we have made but little advance in the study of the etiology of the affection nor have we learned to check the deformities with certainty. We have simply supplied new names for old conditions and the writings of Charcot, Garrod, Heberden, etc., are nearly as accurate as more recent and therefore better known writers.

The great variety of the lesions, the lack of unifomity in the symptoms, and especially the uncertainty of the etiologic factors are responsible for the existing confusion in nomenclature, there being almost as many classifications as there are monographs on the subject. Broadly, chronic joint disease can be divided into those of infectious origin and those which are supposedly non-infectious; the latter embrace those caused by a distinct trauma, by some dyscrasia such as hæmophilia, by some purely functional cause, and those types associated with anatomic change and deformity.

A deforming arthritis may arise as an apparent primary affection, may be secondary (reactive) to disturbed nutrition

* Read before the Philadelphia Academy of Surgery, May 3, 1909.

of the joint, or may be neuropathic, as in tabes or syringomyelia. By a process of exclusion we may arrive at a classification embracing a variety of chronic joint affections which at first seems all sufficient to comprise the clinical material. Actually, in a given series of cases, we may see similar lesions and symptoms due in one patient to a trauma, in another to a well-established previous attack of acute articular rheumatism, in a third to some metabolic disorder, and in a fourth without discoverable cause. An attempt was made a few years ago in England to study rheumatoid arthritis by means of a small hospital where patients could be received for a short time and studied. Bulletins were issued under the leadership of Dr. T. S. P. Strangeways and valuable information gained, but the work was discontinued for lack of funds.

Hypertrophic arthritis, sometimes called osteo-arthritis, is that form of chronic joint disease characterized by a hypertrophy of the cartilage and bone and the formation of osseous spurs at the margins of the articular cartilages or at the attachments of the ligaments. Males of about 45 years of age are most liable to be attacked, and cold, exposure, strains, and various forms of trauma are considered as factors in the etiology. Rimann in a recent paper found 25 knee-joints affected in 100 post-mortem subjects, the disease being in various stages, and in 17 the cause of death was arteriosclerosis in some of its manifestations, in 4 tuberculosis, and in 4 carcinoma. As to the exact cause nothing but speculation has so far been indulged in, the most generally accepted theory being that an autoinfection from defective metabolism causes a fibrous metaplasia of the cartilage, capsule, and ligaments, a thickening from osteosclerosis of the ends of the bones and a proliferation of the bony tissue from the diseased cartilage which is not subjected to pressure.

The cartilage and bone seem to bear the brunt of the disease, as the synovial membrane is not much thickened; there is little villous hypertrophy nor is there much fluid present unless there has been a recent sprain. The cartilage is thickened, glistening, and dense in appearance and at its margin,

*i.e.*, at the junction with the synovial membrane, is congested, often bluish and elevated into ridges and nodules. The latter are most apt to occur at the lateral margins of the knee-joint, along the epiphyseal line and superior lip of the acetabulum in the hip and extending into the lateral ligaments of the fingers, in which case the term Heberden's nodes is often used. If erosion of the cartilage occurs it takes place at points where pressure is brought to bear and is of the nature of decubitus erosions. Detached pieces of cartilage are but rarely observed. The bone is thickened and the cartilaginous masses referred to become ossified and form the characteristic spurs. If erosion of the cartilage takes place the bone may become eburnated, with a polished surface and usually white in appearance, although discoloration with blood pigment may give a reddish color. Ankylosis does not appear to supervene, as a rule, probably from the lack of deposited fibrin. Microscopically the cartilage is thickened and fibrous, the bony trabeculæ are large and thick but there is no evidence of endarteritis nor of a cellular infiltration. Without digressing further I wish to present the following case observed on the service of Dr. C. H. Frazier in the Hospital of the University of Pennsylvania and to whom I am indebted for the privilege of operating upon the patient:

C. W. B. (No. 914); age 69; male. Was first admitted to the University Hospital March 29, 1905, with the following history: Has always been exposed to cold and wet, first as a seaman and later as a locomotive engineer. Had several attacks of gonorrhœa and twenty-five years ago contracted syphilis. Five years ago (August 10, 1900) an enlarged bursa was removed by Dr. Frazier from his right popliteal space and he dates the present trouble from about the same time, although not to the effects of the operation nor to the bursa itself. He suffered from severe pain in the knee when the right leg was extended which, radiating up the thigh, was increased by use. The leg never became locked in flexion or extension. It was believed that he was suffering from some hypertrophy of the synovial membrane with "pinching" of the fringes. On March 30, 1905, Dr. Frazier explored the joint and found the lipping characteristic of a hypertrophic arthritis without displacement of the semilunar cartilages. He

was discharged April 12, 1905, with the instruction to rest the knee as much as possible and to wear an elastic support. He returned several times during the next three years but was merely examined and various forms of local applications prescribed, including the use of the baking apparatus. He was able to work as an engineer until September, 1907, without much pain or serious inconvenience, although he noted that the joint was increasing in size. From this time on the knee began to pain considerably and he was forced to give up working, but could get around with the aid of a cane. He returned to the University Hospital April 11, 1908, and was anxious to have an amputation done if the pain could not be otherwise relieved. The right knee was visibly enlarged but was not very tender nor were there any signs of effusion, the hypertrophy to the touch and to the X-ray being due to bony overgrowth. His joints were generally prominent and some of the metatarsophalangeal joints were also the seat of bony hypertrophy, but they caused no annoyance. The feet were flat and the legs showed varicose veins. He had no prostatic, cardiac, or renal troubles. On April 13, 1908, I opened the joint by a transverse elliptical incision below the patella which disclosed the typical appearance of the disease. The bony outgrowths not only involved the edges of the joint but extended upwards on the anterior surface of the femur for 2 inches. The posterior surface of the patella was similarly involved. The semilunar cartilages were small and narrow, the synovia thickened and slightly congested, there was merely a glairy fluid in the joint, and the internal articulating surfaces showed sufficient erosion of the cartilage to bare the bone. It was thus seen that the creaking and pain were evidently produced by the grinding of the bared bony surfaces and the enlargement and thickening were due to the bony outgrowths. Removal of the latter did not seem to offer any prospect of relief from pain and accordingly I performed a formal excision of the knee-joint. As an arthroplasty was also not deemed advisable the femur was sawed so that its diameter would approximate that of the tibia and allow of fixation in a slightly flexed position. The exostoses were chiselled from the shaft of the femur and from the under surface of the patella. The lateral ligaments were sutured and the patella drilled and fastened over the line of excision by catgut sutures. The skin was closed without drainage and the limb placed on a posterior splint. Healing by first intention resulted and a week

after operation a plaster-of-Paris cast was applied. The patient was discharged June 10, 1908, on crutches with apparent bony union. He returned, however, on July 28, 1908, with pain in the knee and a slight degree of motion, the pain being sufficient to prevent him from working. An X-ray picture showed a distinct line between the ends of the bones and after a week in bed I again operated (August 8, 1908) upon the limb. After dividing the hamstring tendons, a transverse incision was made over the line of excision and the bones pried apart with a chisel. The ends were well curetted and a groove chiselled on either side of the femur one inch above the line of union and from which the bones were fastened together by two silvered steel screws two inches long. The grooves had the effect of countersinking the heads of the screws and enabled them to be driven almost downwards. The wound was again closed without drainage and the leg placed immediately in a cast. It once more healed perfectly and on October 22, 1908, the patient was discharged with bony union, the leg being protected by a light steel brace at the knee owing to the spring of the long lever from hip to ankle. I heard from him in December and he was walking on the limb with but little disability and no pain.*

The treatment of the various manifestations of hypertrophic arthritis will seldom be surgical. Pain, swelling, stiffness, and deformity are the symptoms calling for relief, and an earnest attempt should be made to determine the etiology of the case. Any form of chronic infection, whether from the tonsil, intestine, prostate, etc., must be eradicated, the diet carefully regulated, general massage ordered, and rest of the limb enjoined, preferably by extension if the hip or knee is involved or affected. In hypertrophic arthritis it is obvious that incision and drainage of infected fluid is never indicated, as the disease has never been shown to be due to the presence of bacteria in the joint, nor is there any effusion. The swelling is essentially due to thickening of the bones and the presence of bony outgrowths upon the tibia and femur at the edge of

* After reporting this case to the Academy of Surgery I saw this patient in June, 1909. He had discarded his brace, had been drinking heavily and was in wretched physical condition. The knee pained him considerably at the site of the screws. I advised their removal but he has not returned.

their articular cartilages and which in most cases does not require operative interference. The performance of excision as a primary operation is not generally countenanced although in Germany a number of surgeons have performed this operation in the hope of arresting the disease in other joints. But it is probable that they have confused the acute stage of hypertrophic arthritis with an infectious polyarthritis in which disease prompt operative interference must soon be considered as the treatment of choice.

Pain due to the grinding together of the swollen and eroded cartilages can usually be relieved by rest and extension. When the acute stage has passed, active hyperæmia tends to prevent recurrence of pain, but occasionally, as in the case reported, every attempt made by the patient to resume his occupation is followed by a recurrence. This is especially true in the knee- and hip-joints, and for such cases I would urge the performance of excision, provided that a careful trial of other methods has been practised.

Stiffness or limitation of motion is due to the presence of thickened bone and of the bony outgrowths from the margins of the cartilages, and while the latter can be removed to some extent it will be apparent that in most cases such an operation would have to be very extensive to effect complete removal. When the hip is involved Goldthwait advises the removal of the entire head of the femur in preference to an attempt to remove the individual nodes, and recently Albee has reported 5 cases of partial excision of the articulating surfaces of the femur and acetabulum by a new method, with relief of the pain in every case and the ability to walk without crutches. Sometimes the spurs project into the joint and produce a hypertrophy of the synovial membrane. In occasional instances they may become detached and form loose bodies in the joint, in which case arthrotomy may be necessary.

Deformity is best treated by prevention during the acute stage which if properly managed will be found on subsidence to have resulted in but little change in the relation of the bones. If ankylosis in bad position does occur, especially in the knee or hip, osteotomy must be considered.

# TRANSACTIONS
OF THE
# NEW YORK SURGICAL SOCIETY.

*Stated Meeting held April 28, 1909.*

The President, Dr. Joseph A. Blake, in the Chair.

## PNEUMOCOCCUS PERITONITIS.

Dr. George Woolsey presented a girl, 7 years of age, who was taken sick on January 23, 1909, with sore throat, cough, fever, abdominal pain, anorexia and diarrhœa. Five days later she had a sudden sharp pain in the entire lower abdomen, and vomited repeatedly. On the following day the vomiting ceased, but the pain and tenderness persisted.

On admission to the hospital, on January 30, the abdomen was somewhat distended and symmetrical. The respiratory movements were very restricted. The abdomen was rigid and tender everywhere, especially in the right lower quadrant, and there was a sensation of a mass under McBurney's point. The abdomen was tympanitic except over this mass and in both flanks, where there was shifting dulness to the level of the anterior superior spines. An examination of the lungs showed exaggerated breath sounds over both upper lobes anteriorly, and dulness and diminished breath sounds at the right base and over the outer part of the right scapula. The patient's temperature on admission was 104; pulse, 160; respirations, 56. A blood count showed 67,000 leucocytes, with 94 per cent. polymorphonuclears. The blood pressure was 85.

Operation, January 30: Through a muscle-splitting incision the appendix was found in the retrocolic region; it was removed and was apparently normal. The abdominal cavity was filled with pus, watery above, with a few flakes, and thicker and yellow in the pelvis. As no perforation was found after thorough search in this region, a second median incision was made in the epigastrium, and the stomach, gall-bladder and duodenum examined; but no perforation was found. There was but little pus above

the level. The upper wound was thereupon sutured, and the lower wound closed with a drain to the pelvis. The patient was in fair condition after the operation. She was put to bed in the Fowler position, and continuous enteroclysis given. Her pulmonary condition developed in the next few days into a double lobar pneumonia, and on account of a persistent cough she was placed in a tent with a croup kettle. There was slight distention of the abdomen at first, but after an initial enema the bowels moved freely. The patient's condition was precarious at times, but on the whole she became slightly better. An examination of the pus evacuated from the abdomen showed a pure culture of pneumococcus.

February 6: The patient's temperature at this time was 100.2; respirations and dyspnœa slightly improved; pulse, 140. The enteroclysis and Fowler's position were discontinued. The pulmonary symptoms improved somewhat, and the patient became more rational. There was a slight, shreddy purulent discharge from the lower wound.

During the following week the patient was somewhat better one day, worse the next, and on February 11 the croup kettle was discontinued and she was moved to the roof of the hospital in the open air. Three injections of 10 c.c. of His' serum were given, one on the sixth and two on the eleventh. Her cough had been so severe that the stitches in the upper wound had been torn out. From the time of her removal to the roof, and whether attributable to that or to the use of the serum, she made a gradual but steady improvement. On March 17 the patient suddenly began to vomit, and upon examination of the abdomen an induration was found below the appendix wound. This was broken into by a pair of forceps, and about a pint of foul pus was evacuated. Her further convalescence was uninterrupted, and she left the hospital, cured, on April 10, 1909. She will require subsequent operation for the ventral hernia.

Dr. Woolsey said that very little appeared on the subject of pneumococcus peritonitis in the text-books. In an article by Musser in Osler's System the statistics given showed a very high mortality. Since operating on the above case the speaker said he had seen a second case of pneumococcus peritonitis in a woman, with a history dating back five days, who was brought to the hospital in a moribund condition and who died within a few hours without operation. At the autopsy, nothing was found

excepting free pus in the abdominal cavity which upon examination showed a pure culture of the pneumococcus. The abdominal, pelvic and thoracic viscera were normal.

### STRANGULATED INTERSTITIAL HERNIA IN THE FEMALE. PROPERITONEAL HERNIA IN THE FEMALE.

DR. WILLIAM B. COLEY presented these two cases, which are described in full in his paper on Inguinal Hernia in the Female, for which see page 609.

### DOUBLE INGUINOPERINEAL HERNIÆ, WITH DOUBLE ECTOPIA TESTES.

DR. COLEY presented a boy of 12 years, who was operated upon at the Hospital for Ruptured and Crippled in March, 1909. On the right side there was found a bilocular hernial sac, the upper loculus being of the inguinosuperficial variety and extending over the aponeurosis of the external oblique half way to the anterior superior spine. The lower loculus extended into the middle of the perineum. The testicle itself was found within the internal ring.

On the left side the sac was monolocular, extending into the perineum nearly to the anus. The testicle was found in the midperineum. The scrotum was entirely empty. The sac was closed on both sides high up beyond the internal ring, precisely as in Bassini's operation for hernia. The lower end of the sac was removed from the perineum, carefully sutured over the testicle, and the testicles then placed in the new pouches made by digital dilatation in the bottom of the scrotum. The cord was not transplanted on either side, and was of sufficient length to allow the testicle to rest in the bottom of the scrotum without tension. The patient made a perfect recovery and left the hospital at the end of two and one-half weeks. The testicles at present were in the bottom of the scrotum, and of normal size.

Dr. Coley stated that he had operated upon 11 cases of inguinoperineal hernia with perineal ectopia, but this was the only case he had seen in which the condition was double. While formerly he believed that in many cases this condition was acquired, he no longer held this view, and now regarded all such sacs as of congenital origin. This case furnished almost positive proof of the congenital origin of the sac, inasmuch as on the right side, while the sac extended into the perineum, the testicle itself was in the abdomen.

## THE RESULT OF BIER'S TREATMENT OF TUBERCULOSIS OF THE TARSUS.

DR. WILLY MEYER presented a girl, 30 months old, who had tuberculosis of the tarsal bones of both feet, several of the bones being the seat of tubercular foci. An attempt was first made to extirpate part of the bones, but the disease was so far advanced that this was abandoned for conservative reasons, and Bier's treatment was instituted. Every day the elastic bandage was applied for eleven hours out of every twelve, according to Bier's method, and in addition to this, suction was applied by means of a large glass for 45 minutes, such as was usually employed in the treatment of mastitis, but here adapted to the child's foot with the help of a rubber cuff. After a time, the child was taught to apply the proper amount of suction herself, by working the suction pumps. In this way her timidity was overcome. Gradually, the discharge ceased, and when the patient left the hospital, on August 1, 1908, the sinuses in both feet had entirely closed. She was now able to go about and was practically well. The mother had been instructed to continue the use of the elastic bandage during the night and have braces made to overcome the tendency to the development of flat-foot.

## URETEROPLASTY FOR INTERMITTENT HYDRONEPHROSIS.

DR. MEYER presented a girl, 18 years old, who three years ago began to complain of attacks of pain, intermittent in character, in the left lumbar region. These attacks usually lasted for ten or twelve days. At first they recurred every three or four months, and then with increasing frequency and severity until finally the patient became absolutely disabled.

Upon examination, Dr. Meyer found a large tumor in the left lumbar region which was apparently connected with the kidney, and which spontaneously disappeared simultaneously with the pain, in the course of a few days.

Operation: After resection of the twelfth rib through a posterior longitudinal incision, he came down upon an œdematous hydronephrotic sac, only partially filled. The ureter was angled. It was decided to make an attempt to save the kidney. A ureteroplasty was thereupon done, adapting the Finney method to the distended renal pelvis and upper portion of the ureter. On

account of the thinness of the sac only one line of continuous suture could be made. Catgut was used.

There was first some leakage from the wound after the operation, but the patient made a good recovery, and soon began to pass urine in large quantity. She had been free from attacks since the operation and was now apparently enjoying excellent health.

## CRANIOTOMY FOR TUMOR OF THE BRAIN: DECOMPRESSION OPERATION.

DR. MEYER presented a man, 47 years old, who was admitted to the German Hospital in February, 1909. His family and previous histories were negative; venereal disease was denied, and his habits were good.

About seven weeks prior to his admission he began to complain of attacks of pain, neuralgic in character, affecting the right side of the head, the corresponding side of the face above the jaw, and the right teeth. These attacks were of gradual onset, occurring as frequently as every two hours, and were of increasing intensity. His eyesight had been failing for ten months.

Examination showed that this area of neuralgic pain corresponded with the distribution of the first and second divisions of the trigeminal nerve. There was weakness of the muscles of the right face and atrophy and weakness of the right masseter and pterygoid. There was increasing optic neuritis of both eyes, particularly the right, with slight nystagmus affecting both eyes. There was analgesia of the face, gums, roof of mouth and cornea of the right side. The gait at times was staggering in character, with deviation always to the right side. The right masseter muscle showed increased galvanic and faradic excitability. While in the hospital, the patient had several epileptoid attacks, consisting of (*a*) complete loss of consciousness; (*b*) deviation of the right eye to the left; (*c*) after these attacks, a paresis of the right abducens.

A tentative diagnosis of tumor of the brain, located probably in the region of the right Gasserian ganglion, was made, and on March 11, 1909, an exploratory craniotomy and decompression operation was done. The important points of this were: (1) The formation of a temporal osteoplastic flap, with its pedicle anterior to the ear. (2) Elevation of the petrosal periosteum,

exposing an apparently normal Gasserian ganglion. (3) Ligation of the right middle meningeal artery. (4) Removal of bone for decompression. (5) Removal of subjacent dura mater. (6) Remarkable thinness of squamous portion of temporal bone was noted. (7) Before incision of the dura, the brain appeared to be under considerable tension. (8) Brain surface did not appear resistant at any place to the palpating finger, also not at the base.

On the seventh day after the operation the flap was noticed to bulge slightly. There was involuntary defecation, and paresis of the left side of the face became apparent. The bulging of the flap gradually became more marked. On the thirteenth day there was paralysis of the left arm and leg; the patient was in a state of coma, and his condition was becoming serious. Puncture of the brain through the flap brought no fluid. Lumbar puncture was then done, and 40 c.c. of clear, straw-colored fluid was withdrawn. Light pressure on the skull flap caused an increase in the speed of the flow, and when the patient left the table the flap was already soft. Two hours later it was slightly scaphoid. On the fifteenth day the wound was again under such tension that a second lumbar puncture seemed necessary. But a few hours later a deep hollow again appeared, where shortly before the flap had been bulging. On the seventeenth day the patient could move the affected arm and leg and was able to answer questions intelligently. Since then his condition had gradually improved. The frequent change in tension of the flap continued for several weeks. According to experiments with various drugs it appeared that the changes were not due to changes in blood pressure, but rather to such in cerebral circulation. The patient had at present only slight weakness in the left arm and leg, with a paresis of the left side of the face and throat. He complained of persistent headache in the region of the vertex. The optic atrophy was increasing, especially in the right eye.

## EMPYEMA: IMMEDIATE DISTENTION OF THE LUNG WITH THE HELP OF THE NEW POSITIVE DIFFERENTIAL PRESSURE APPARATUS.

DR. MEYER presented a boy, 4½ years old, who, when he entered the hospital four weeks ago, gave a history of pneumonia of both left lobes followed by a purulent collection in the left

pleural cavity. A resection of the rib was made in the usual way; and the pus given proper exit. The masses of fibrous coagulation were thoroughly removed. Then the boy's head was placed in the positive differential chamber, and under a pressure up to 14 mm. There was immediate expansion of the inflamed lung. Still, it could not be distended sufficiently to bring the visceral pleura in contact with the costal, however. The wound was not drained. A very extensive dressing was then applied, differential pressure being continued, with the idea of preventing the access of air. Immediately following this operation the boy's temperature dropped, and his breathing was improved. First change of dressing six days later, with positive pressure. Lung seen in front of wound of better (pinkish) color; slight discharge from wound. After another week the boy had a sudden rise of temperature. His head was again put into the compressed air apparatus, and upon removing the dressing it was found that the wound had become closed by granulations. Upon gradually increasing the pressure, these granulations gave way, and there was a tremendous gush of seropus from the wound. A gauze drain was thereupon inserted. Following this, the patient's temperature again dropped. After six days there was another slight rise. He was again placed under the influence of compressed air and a small cigarette drain was inserted, which he still retained. At the present time he was placed in the differential chamber every day, and made to breathe under the increased air pressure. With the aid of such an apparatus, Dr. Meyer said, he thought our method of the after-treatment of empyema would be simplified, especially in adults, in whom it usually took so many weeks to bring the empyema cavity to a definite close. The effect of the differential air pressure apparatus will naturally be of greater effect when resolution of the lung tissue has been completed after cessation of the pneumonic symptoms. It stands to reason, that the inflamed lung with its reduced elasticity cannot be easily distended.

### EXPLORATORY THORACOTOMY, UNDER POSITIVE PRESSURE, FOR ŒSOPHAGEAL CANCER.

DR. MEYER presented a man, 37 years old, who first experienced difficulty in swallowing about seven months ago, due to the presence of a cancerous growth of the œsophagus. The

dysphagia gradually increased, and as it was impossible to dilate the stricture from above, it was planned to make an effort to reach the diseased portion of the œsophagus through an intercostal incision, then draw part of the stomach upwards into the thorax, and after resection perform œsophagogastrostomy. Careful measurements, made prior to the operation, had shown that the œsophageal obstruction was apparently located about six centimeters above the cardia. On April 17 the incision was therefore made in the eighth left intercostal space and the ribs drawn apart by means of Mikulicz's rib spreader. At this point a number of old pleuritic adhesions were encountered, fixating the lower lobe of the lung to diaphragm and chest wall; these were gently loosened. Upon finally reaching the œsophagus, the cancerous growth was found to be located at a higher level, embracing at least five to eight centimeters of the œsophageal tube. It was inaccessible from the exploratory thoracotomy wound. The wound was thereupon closed, as it seemed unwise to tax the reduced patient's strength too much. At a subsequent time, perhaps, Dr. Meyer said, he would undertake a second operation on the patient, making the incision higher up on the thorax. He would then attempt to excise the tumor and close both ends of the œsophagus. A gastric fistula had, of course, to be established for permanent feeding.

## MULTIPLE SYMMETRICAL LIPOMATOSIS.

Dr. Otto G. T. Kiliani presented a man, 48 years old, with multiple symmetrical lipomata involving the face, neck, chest, and abdomen. He stated that these tumors, some of which were of mammoth size, so that they constituted a real deformity, began to develop about six years ago. He was first operated on by Dr. Kiliani on June 30, 1906, when three of the growths were removed, one in each parotid region and one underneath the lower jaw, overhanging the chest. He made a prompt recovery from the operation, and there had been no recurrence of the growths at the site of the removals.

Since then a large lipoma had appeared on the back of the neck, and there were numerous others involving the cheeks, mammæ, deltoid region and back. Some of these growths had remained unchanged for a number of years, and one large lipoma of the abdomen had disappeared spontaneously. They had never given rise to any pain or other symptom. Dr. Kiliani said his

intention was to remove those which were unsightly, as they interfered with the man's occupation, which was that of a bartender. (See Figs. 1, 2 and 3.)

## THORACOPLASTY.

DR. KILIANI presented a man, 38 years old, who was first operated on in Hamburg about two and a half years ago for empyema, a rib resection being done. He was first admitted to the German Hospital on August 4, 1908, with the following history: About four years ago he had pneumonia, followed in the course of two months by empyema, necessitating a resection. This wound healed, but reopened spontaneously three months later, and after discharging pus for several months it again closed. Since then it had reopened and closed several times. He complained of a dry cough, without expectoration. He had occasional night sweats and had lost some weight.

Examination of the chest at that time showed a cavity which extended upward and forward to a depth of seven and a half inches. No bare bone could be felt. Percussion over the entire right chest wall was flat, with increased fremitus and voice and breathing sounds.

Operation, August 10, 1908, by Dr. Stetten: An incision was made through the old scar and the eighth rib was resected. The sinus which passed through this rib led to a cavity from which about a quart of pus was evacuated. The cavity was packed with iodoform gauze. The patient left the hospital on October 19, 1908, improved, and was referred to the dispensary for further dressing.

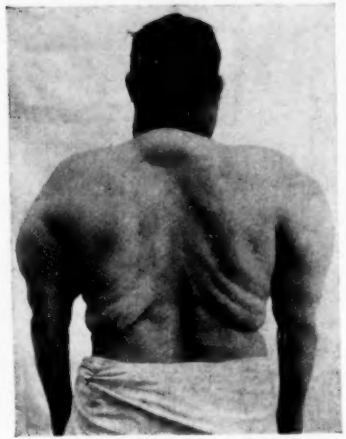
When the patient was readmitted to the hospital, on November 29, 1908, the fistulous tract was still open and as there was considerable purulent discharge, he was again operated on, December 3, by Dr. Stetten. At this operation about four and a half inches of three of the ribs were resected, in order to permit the rigid outer wall of the abscess cavity to collapse. In spite of this the discharge persisted, and although the greater part of the wound closed, a fistula remained which led to a cavity running upwards behind the ribs. Bismuth-vaseline mixture was injected into the cavity every second day, but there was no marked improvement. An X-ray plate showed that the cavity extended upwards to the fourth rib.

On March 27, 1909, the first stage of a thoracoplasty was

FIG. 1.

FIG. 2.

FIG. 3.



Multiple symmetrical lipomatosis.

done by Dr. Kiliani. The entire scapula was freed, and portions of the fourth, fifth, sixth, and seventh and about seven inches of the eighth ribs were resected. There was considerable bleeding following this procedure, which was controlled by tampons.

Six days later the second stage of the thoracoplasty was done. The anterior portions of the ribs previously resected were removed at the costochondral junction, and a more extensive resection of the upper ribs was done as high up as the fourth, until the entire cavity was laid bare. Its outer wall, which was half an inch in thickness, was removed entirely. Its inner wall, which rested on the lower lobe of the lung, was stripped off. There was considerable bleeding, which was checked by tamponades. As soon as the thick membrane was removed, the lung, which had been incarcerated by this pseudomembrane for two and a half years, immediately expanded, bulging out about four inches. The cavity was packed and the chest flap allowed to fall over, being sutured only at the angles. The patient made an excellent recovery, and now had very fair breathing capacity on the affected side.

Dr. Charles N. Dowd, speaking of Dr. Kiliani's case of thoracoplasty, said he had obtained the best and easiest exposure of the thoracic sinus by an incision carried upward at the anterior axillary line, cutting off as much from the cut ends of the ribs as was desirable, and removing a portion of the pulmonary pleura, and that the resulting deformity was less than after the Schede operation.

Referring to the expansion of the lung after freeing it, Dr. Dowd said that since the publication of Dr. Lloyd's article, some years ago, he had permitted his patients to come out of the anæsthetic after the incision was made and had allowed them to cough, and in almost every instance this produced expansion of the lung. Almost as much was gained, he thought, by allowing the patient to cough as by the use of an apparatus. He recalled one case where the patient developed a pneumonia in the expanded lung. While early expansion of the lung was of advantage, it had not, in his experience, greatly hastened the closure of the cavity very much over older methods of technic. He had successfully maintained negative chest pressure by means of Colton's apparatus, which was constructed on the principle of the Bunsen filter pump.

Dr. Kiliani said that in his case the lung had been incar-

cerated for two and a half years, and the thorax was tremendously thickened. It was at least two and a half inches in thickness, and its removal necessitated a very wide exposure.

Dr. Meyer, referring to the possibility of rendering the thoracoplasty wound air-tight, said the use of a rubber dam had been proposed which would allow the fluid to run out without giving access to air. The use of an apparatus with negative and positive pressure would probably go far to simplify the treatment of these cases, and perhaps save the occurrence of long-standing fistulous openings.

## HOUR-GLASS STOMACH: GASTROGASTROSTOMY.

Dr. William A. Downes presented a woman, 33 years of age, whose case furnished the subject of a paper by him on Hour-glass Stomach, for which see page 552.

Dr. F. Kammerer said his experience with hour-glass stomach was limited to a few cases. One of them, which he had observed nineteen years ago, was a young girl of about 17 years, who was brought to the hospital in a condition of extreme emaciation. The patient died without operation, and the autopsy showed a narrowing just at the middle of the stomach, dividing that organ into two equal pouches. There were no evidences of any ulcers or cicatrices, and for that reason the case was regarded as one of congenital malformation at the time.

In another case, Dr. Kammerer did a gastroplasty and found it very easy to approximate the edges of the two pouches. This case has been referred to often in medical literature. Under such condition he considered gastroplasty preferable to gastrogastrostomy, because it left one large communication between the two pouches. When the cicatrices were very firm, it might be impossible to do a gastroplasty.

French surgeons have been much interested in the subject of hour-glass stomach lately and have contributed new methods for the treatment of this ailment, such as double gastro-enterostomy and resection of the stenosed portion of the stomach, as hour-glass stomach is so often complicated by a stenosis of the pylorus, the single operations, first referred to, are frequently insufficient.

Montprofit has strongly advised that in all cases in which a gastro-enterostomy was indicated, the anterior operation should be done, and not the posterior, and that a communication should

be established between both pouches by the Y-shaped method. Dr. Kammerer said he was inclined to agree with the suggestion of this French writer in such cases.

Dr. Charles L. Gibson said that in the only case of hour-glass stomach that had come under his observation where he did a gastrogastrostomy the patient's nutrition was improved, but the operation failed to relieve the pain, and there was still occasional vomiting. The patient had refused further operation.

Dr. Charles A. Elsberg said that during the past six years he had seen two cases of hour-glass stomach, one following carcinoma, the second an ulcer. In the latter he did a posterior gastro-enterostomy, which gave the patient relief. In the first case he did a gastrogastrostomy, making the opening very large, which also gave relief. The opening left between the two pouches was very large and extended from the greater to the lesser curvature.

Dr. Joseph A. Blake said that one cause of failure of these operations was due to the common occurrence of stenosis of the pylorus in hour-glass contraction. A stomach which he saw removed from a child about a year ago, the supposed hour-glass stomach of congenital origin, proved to be atresia of the duodenum, with a widely dilated pylorus.

## POSITIVE DIFFERENTIAL CHAMBER FOR INTRATHORACIC SURGERY.

Dr. Willy Meyer demonstrated his new positive differential chamber for intrathoracic operations, which had been erected in a temporary operating room, set aside for the time being for this kind of work at the German Hospital. The same chamber is used as the anæsthetizing room as a part of his "universal differential chamber," which, Dr. Meyer said, he is now testing at the Rockefeller Institute. He described its new constructive features and comparative advantages, laying special stress on the fact that it gives the operator sufficient elbow-room and room for a second assistant on his left side, permits of direct conversation between surgeon and narcotizer, offers opportunity for the surgeon to observe the patient's face and the transportability and therewith adaptability of the apparatus to the requirements of military surgery.

Dr. Meyer also demonstrated a new operating table which he had designed for intrathoracic work.

# TRANSACTIONS

OF THE

# PHILADELPHIA ACADEMY OF SURGERY.

*Stated Meeting held May 3, 1909.*

The President, Dr. William J. Taylor, in the Chair.

## MULTIPLE FRACTURES, INVOLVING THE FACE BONES, THE LEFT ELBOW, AND BOTH FEMURS.

Dr. Astley Paston Cooper Ashhurst said that in a paper on Multiple Fractures, which he read before the Philadelphia Academy of Surgery in April, 1907 (Annals of Surgery, 1907, xlvi, 263) statistics were presented showing that multiple fractures form only about 1.44 per cent. of fractures in general, and that the mortality at the present day is at least 25 per cent., even when cases of crush of the extremities calling for immediate amputation and other cases dying in a few hours from shock are excluded. The mortality of fractures in general was found to be about 2.7 per cent., so that the outlook in a case of multiple fractures is just about ten times as gloomy as in ordinary cases. The case now reported, with the kind permission of Dr. Chas. H. Frazier, is one in which, in addition to numerous other fractures, both femurs were broken and could not be reduced without operation. Among the 73 cases of multiple fractures from the statistics of the Episcopal Hospital, reported in 1907, there were only two in which both femurs were fractured; both of these patients died. Among 121 recent fractures of the femur at the Episcopal Hospital, reported a year ago (Annals of Surgery, 1908, xlviii, 748) in collaboration with Dr. Wm. A. Newell, there was not one case in which operation had to be done. So that the present case is remarkable both for his recovery, and from the fact that operation was required on both femurs.

Frank R., a sailor, aged 26 years, was admitted to Dr. Frazier's service in the Episcopal Hospital at 7 P.M., December

5, 1908. While at work on a ship lying at the dock he had fallen a distance of fifty-five feet into the hold, landing on piles of copper ore.

Examination showed the following injuries: There was no vision in the left eye, the pupil being widely dilated, with hemorrhage into the anterior chamber, and dislocation of the lens. The left malar bone was broken near its articulation with the superior maxillary. Both the right and left superior maxillæ were fractured, the line of fracture crossing the median line of the alveolus. There was a comminuted fracture of the nasal bones. The inferior maxilla was broken in three separate places: (1) through the left ramus; (2) just to the left of the symphysis; (3) through the body on the right side. The left humerus presented a fracture of the external condyle; and there was a fracture of the head of the left radius, with dislocation, along with the fragment of the humerus. There was a comminuted fracture of the right femur into the knee-joint, the internal condyle with a fragment of the posterior surface of the external condyle being dislocated posteriorly along with the tibia and fibula, the patella being impacted between the fragments, and the external condyle jutting out and almost rupturing the skin, in the neighborhood of the head of the fibula; the skin, though much abraded and contused, was not broken. In addition to these injuries there was a compound comminuted fracture below the middle of the left femur, with rupture of the ligamentum patellæ, and a large hæmatoma over the seat of fracture.

The man was in profound shock. His temperature on admission was 95.4° F. By midnight it had risen to 97.8° F., and the next morning reached normal. He was appropriately treated for the shock, and though death seemed imminent, dressings were applied to the various fractures. A chin-cap and Gibson bandage were applied to the face; the dislocation of the radius was reduced, and the elbow was dressed in acute flexion. Buck's extension and sand-bags were applied to each lower extremity. It was imposible to reduce the fracture-dislocation of the right knee; and no great force was used in attempting to set the left femur, as the condition of the soft parts (hæmatoma and wound of compound fracture) did not warrant it.

Contrary to expectation, the patient's general condition gradually improved; his temperature on the afternoon of the second

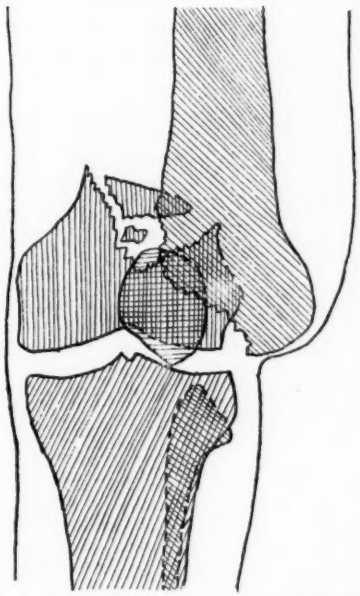
day was 100.6° F., and this was the highest ever reached. The wound in the left thigh healed without becoming infected.

On December 11, six days after admission, Dr. Frazier attempted under ether to reduce the dislocation of the right knee, but was unable to do so. It seemed imperative to secure reduction, as the skin was stretched so tightly over the projecting external condyle that it was feared sloughing would soon occur. Accordingly, the next day Dr. Ashhurst operated for Dr. Frazier, as the patient, though still delirious, seemed able to stand a formal operation. In order to avoid the abraded and granulating skin, which was swabbed with iodine before beginning the operation, the joint was opened as for a fracture of the patella, by a curved incision, with convexity below (the ligamentum patellæ was not divided). This flap was turned up, and the external condyle was found projecting through the capsule of the joint, just beneath the skin. The capsule was therefore opened, but reduction was still impossible, as the patella was firmly fixed between the shaft of the femur, above the external condyle, on its outer side and the inner condyle on the inner side. The patella was rotated about 90 degrees on its longitudinal axis, so that its anterior surface looked outward (Fig. 1). To extract it, the rectus femoris had to be cut from the vastus externus, and then the patella could be pried out from behind the condyles, and the fracture reduced. As very good apposition of the fragments was obtained, no wires, screws, or plates were used to retain them. The quadriceps tendon was sutured again to the vastus externus, and the capsule was then closed, buried sutures of chromic gut being used in both instances. The skin wound was closed with interrupted sutures of chromic gut, and a small drain of plain catgut was left beneath the skin at the outer angle of the incision. This was of course absorbed in a few days, but served the purpose of temporary drainage into the dressings, and obviated the necessity of trapping the cast for its removal. Strict *asepsis* was used throughout the operation, which took thirty-five minutes. A Buck's extension was then applied, and over all the dressings a plaster cast, which extended from the toes to the groin. The entire operation was done while the patient was lying in his bed, as it was feared that removal to the operating table might injure his other femur. During this anæsthetization the patient's upper and lower jaws, which had begun to knit, were

unavoidably refractured. The next day his temperature was normal, but on the second day it reached 100.6° F., and then again became normal. The cast was left on for over five weeks, and on removal (January 19, 1909) the patella was found movable, and the fragments firmly united and in excellent position. There were a few granulations at the outer angle of the wound, where it had been drained. Passive motion was then begun.

When four weeks had elapsed from the time of the accident,

FIG. 1



Tracing of skiagraph of right knee. Comminuted fracture through external condyle of femur, with posterior dislocation of tibia and lower fragment and impaction of patella between fragments.

it was found that there was no union in the left femur, which had been the seat of a compound comminuted fracture; and as the skiagraph showed overlapping of about two inches, and as this could not be reduced by traction, it seemed proper to operate on this femur also.

Accordingly, on January 2, 1909, when substituting for Dr. G. G. Davis, and after consultation with Dr. Frazier, Dr. Ashhurst operated on the left femur, through an external incision of 8 inches, excising the callus which prevented reduction, and

removing some loose fragments of the shaft. The upper fragment was anterior and inward, projecting into the rectus muscle. It was possible to secure very good apposition without resecting any of the femur, as the fracture was nearly transverse, and the comminution involved the inner surface only. A silver plate, with three screws in each fragment, was used to retain the bones. The wound was thoroughly washed out with hot bichloride, and was closed with two layers of buried sutures of chromic gut, which was also used for the skin sutures. A rubber drainage-tube was brought out through the lower angle of the wound, passing beneath the bone to the inner side of the line of fracture. The time of the operation was sixty-five minutes. A Buck's extension was applied, and over all a plaster cast from the toes to the groin. The drainage-tube was removed through a window in the cast on the second day. On the third day the temperature reached 100.6° F., and then again fell to normal. This cast was removed February 8, 1909, during the sixth week after operation. The position of the fragments was good, and fibrous union was present.

In March, the patient was about in a wheel chair, and motion in the knees was improving. Dr. Van Pelt took charge of the ocular condition, and sight gradually returned. Early in April the patient began to walk with crutches, and in two weeks time could walk with only one cane. He now walks without support of any kind. The right knee has slight lateral mobility in full extension, and for some time felt a little weak in walking. The left femur has bowed somewhat outward, but union is firm, and the silver plate is producing no irritation. The right lower extremity is only one-half a centimetre shorter than the left. Both knees have a range of motion through about 40 degrees—from full extension to about 140 degrees. The fractures of the face have healed with only slight deformity, the alignment of the teeth being perfect, and very little distortion of the features remaining. The left elbow has a range of motion from 40 to 140 degrees, full extension being impossible on account of thickening of the head of the radius. The ruptured left ligamentum patellæ gives no further trouble. The left eye can now be used for reading, and the patient declares it to be as good as his other eye; the pupil remains dilated.

## RESECTION OF COLON FOR CANCER AND FOR TUBERCULOSIS.

Dr. John H. Gibbon delivered the annual oration before the Academy upon the above theme, for which see page 571.

## SURGICAL ASPECTS OF HYPERTROPHIC ARTHRITIS.

Dr. George P. Muller read a paper with the above title, for which see page 630.

## INSTRUMENTS FOR OPENING THE SKULL.

Dr. William W. Keen exhibited an apparatus, consisting of a brace with four bits, devised by Dr. W. H. Hudson of Montgomery, Alabama. The peculiarity of the first two (the smaller) bits is that one can penetrate through either a thick or thin skull as far as the dura and the bit will go no farther. The others are globular bits and they will penetrate, but they are provided with a slight button on the end so that when the entire thickness of the skull is penetrated, even if the middle meningeal be directly under the drill, it will be pushed off, provided it is not in either a narrow groove or in a foramen. If it is, of course any drill would cut it just exactly as the ordinary saw or chisel would. The advantage of these bits is that one can very quickly make four openings and then can add three more, intermediate openings if desired, and introduce from one to the other a Gigli saw or bite the bone between them by Devilbiss' or other forceps as desired, turning down a flap in a very few minutes.

In Dr. Keen's opinion these bits provide the best means yet devised for opening the skull, having the safety of the chisel and the speed of the saw.

# CORRESPONDENCE.

## INTESTINAL ANASTOMOSIS BY INVAGINATION.

EDITOR ANNALS OF SURGERY:

Would you permit me to describe one or two improvements, as the result of additional experience, to the method of performing intestinal anastomosis, an account of which you were kind enough to publish in the ANNALS for May. In two cases of excision of the cæcum for tuberculosis, after removal of the diseased segment, I inverted the edges of the orifice of the distal segment and closed with a "purse-string" suture, which much simplified and shortened the process of occlusion. And, further, I found that a "continuous" instead of an "interrupted" Lembert suture, for uniting the walls of the invaginated bowel to the margin of the incision into the paries of the distal segment, was easier and more rapid in execution.

I would like to add that one important postoperative procedure, which experience has taught this particular method of intestinal anastomosis admits, is that early feeding by the mouth may be indulged in; indeed, food may with perfect security be given as soon as the effect of the anæsthetic has passed off; and in cases of removal of portions of the bowel for tuberculosis or carcinoma this item in after-treatment is of no small moment.

GLASGOW, MAY 24, 1909. A. ERNEST MAYLARD.

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Remittance for Subscriptions and Advertising and all business communications should be addressed to the

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